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Optics in Metal Working

I—The Toolmaker's Microscope

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Bausch & Lomb

THE master craftsman of our grandfathers' day was renowned for his uncanny skill and judgment. He could fashion an article from the raw materials; he was the originator, builder, and salesmen of his product; but he has been crowded out of our present American picture by the speed and precision of modern machines and the division of labor into groups of specialists. Today, in mass production, a girl assumes part of the duties of the one-time craftsman; and with suitable tools she can check or measure a hundred times more accurately.

As this is the first of a series of articles on the optical measuring methods used in the metal industries, it seems best to discuss the principles involved, before describing the instruments that are used.

Magnification is the common means employed for visual inspections. You would not judge the ensemble of the paint job on your house from a mile away but would come up to within 50 or 100 feet; and again, to examine the surface for blisters or poor covering you would approach to within 10 or 20 inches. This is magnification; a larger image is received on the retina of the eye when the eye is brought nearer the object. Magnification is carried still farther when a paint expert arrives and uses a magnifier which permits him to place his eye an inch or so from the surface, or a sample of the paint is placed under a compound microscope and higher magnification is available due to the optical system. Whether we approach more closely or construct an optical system, our requirement is a larger image on the retina, or as the optician expresses it, we seek a larger angle of subtense.

The unaided normal eye will not permit observation at less than ten inches. An optical system, however, theoretically permits one to place his eye down very close to the work. This actually happens in using a hand magnifier, but the optician has made an improvement in designing the microscope. The light rays are carried up, through a tube, for six or seven inches. You do not

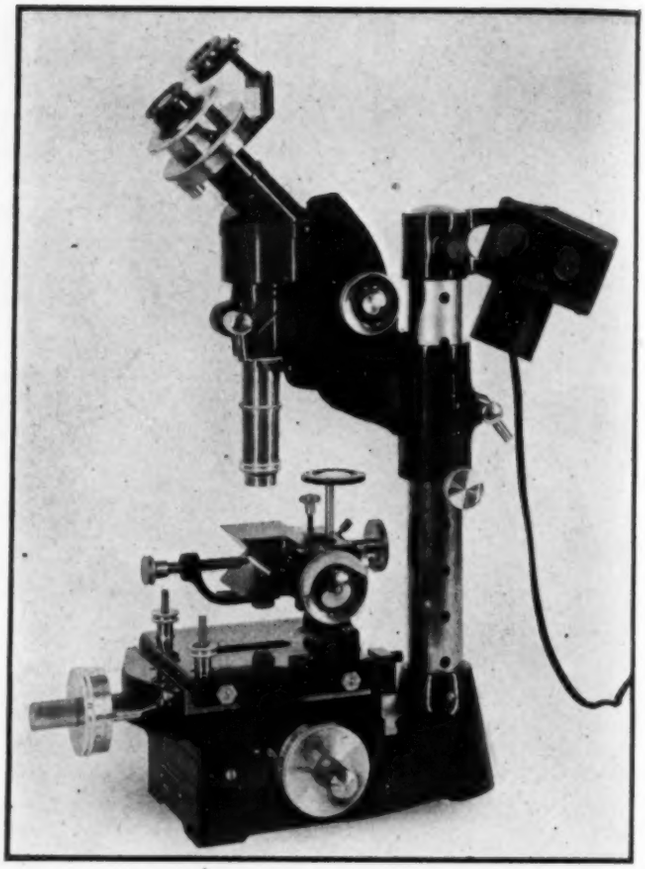
have to place your eye close to the work, but may examine work comfortably, altering the magnification by changing the optics whenever you desire to get a finer detail.

It is easy to see from our illustration in the preceding paragraph that the greater the magnification the smaller the area that can be seen at one time. From 50 to 100 feet away you can view the entire house, but from 2 to 3 feet away you can only see a portion of the wall, unless you move your head.

Measurements can be made directly upon an enlarged image as seen by the aid of a microscope, provided the optics are correctly designed and carefully made. A graduated scale may be placed in the optical system so that it seems to lie on the surface of the object. Measurements are also made by moving the object (or a cross hair in the eyepiece) by means of a micrometer screw and then reading the measurements directly from the micrometer drum.

Instead of the observer looking into a microscope tube and examining an enlarged image of an object, the enlarged image can be projected onto a screen where it may be measured or compared with standards. This method is especially useful for examining and measuring the contours of irregular parts such as screw threads, gears, cams, etc. The projection method is the better for routine inspection whenever it can be adapted, and is used in many inspection departments.

A precise length measurement is possible when using a light beam as a lever. A pencil of light is reflected when it strikes a mirror and when the source of light remains in a fixed position and the mirror is tilted, the reflected beam moves through twice the arc—twice the number of degrees that the mirror moves. This principle gives us a light beam leverage of 2 to 1 and if we wish to measure objects we can place a graduated trans-



The micrometer drums of this toolmaker's microscope permit a direct reading to one ten-thousandth of an inch. They may be used to position an object and measure definite distances

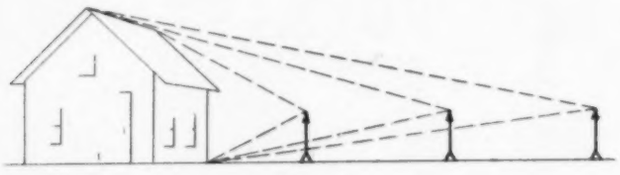


Fig. 1

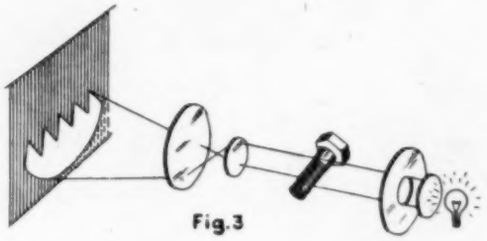


Fig. 3

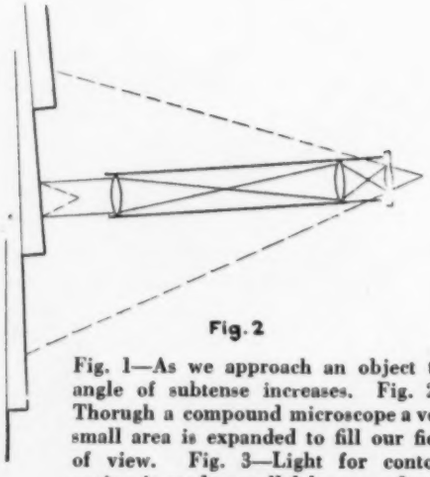


Fig. 2

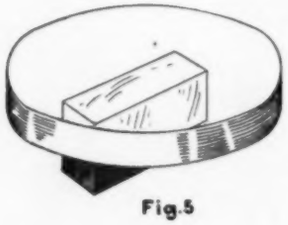


Fig. 5

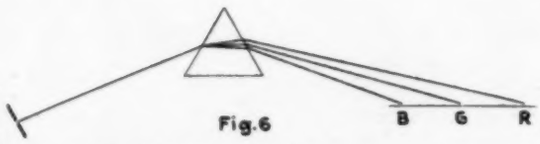


Fig. 6

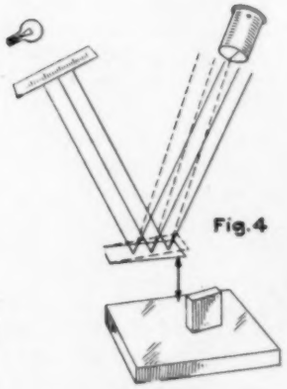


Fig. 4

Fig. 1—As we approach an object the angle of subtense increases. Fig. 2—Thorugh a compound microscope a very small area is expanded to fill our field of view. Fig. 3—Light for contour gaging is made parallel by a condenser lens, is passed across or around the object, through the objective and eyepiece lens, and then forms an enlarged silhouette of the object on a screen. Fig. 4—The light beam lever is an accurate measuring device. Fig. 5—The interferometer by reflecting varying light from irregularities in a surface produces colored bands called Newton's Rings. The shape and number of the rings indicate the variation from flatness. Fig. 6—Light made up from unknown incandescent materials can be analyzed by means of a prism, photographed, and the unknown materials positively identified by their colors

parent scale in the light beam, then measure our parts by placing them under one edge of the mirror, thus tilting it to a different angle. The reflected beam can be thrown on a screen where it will image the scale, and the greater the distance from the mirror to the eye the greater will be the mechanical advantage of this light ray lever. The position assumed by the scale will serve as a means of measuring the part. Greater accuracy is obtained in this way than with mechanical methods and the illuminated scale is kind to the eyes.

You have doubtless seen oil floating on water and noticed the iridescence—the tiny rainbows that appear. This phenomenon is caused by light wave interference and is used for checking the surface accuracy of standard gage blocks and for comparing extremely precise lengths. When light waves strike a surface they are reflected, and when two surfaces are very close together, such as the top and bottom surfaces of an oil film, the light waves are reflected from both surfaces, but because of the greater distance to the second surface the reflections of the light waves interfere, producing bands of color instead of white light. A very slight difference between the surfaces produces a difference in color, and a difference of only several millionths of an inch between the surfaces causes widely separated bands of color.

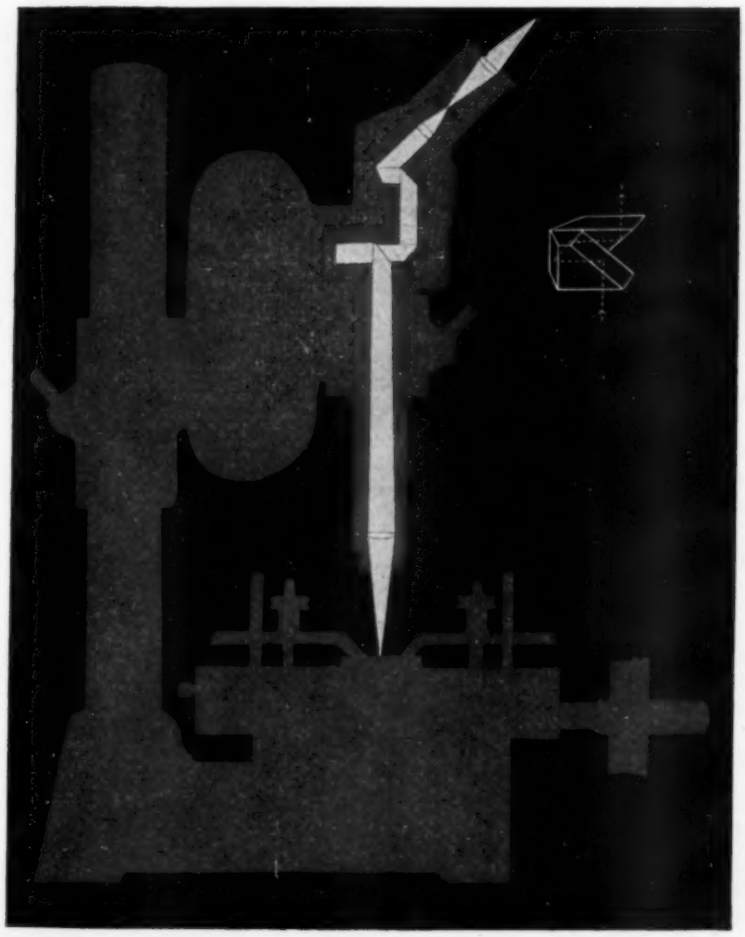
This method is used to test surfaces by using a master surface of a transparent medium, glass or natural quartz, which is as nearly flat as master opticians can make it. The master surface is wrung onto the surface in question, and the color bands counted to determine the inaccuracy. These bands are known at Newton's Rings and have been used to determine the accuracy of lens surfaces for many years. This method is used in the machine shop to determine the accuracy of standard gage surfaces and to compare the lengths. Among other applications of optical methods of keen interest to the metal industry is spectrum analysis. Any material, when volatilized, that is to say when changed to an incandescent gas in an electric arc or spark, will show characteristic lines in its spectrum. The light from the incandescent vapor of the material is broken up into colors of the spectrum by a prism and the spectrum is photographed. This record tells the metallurgist exactly what materials he is working with, in a fraction of the time and with much greater dependability than by most chemical methods. Special methods have been devised by means of which the quantity of small adulterations can be determined to a degree of accuracy beyond the possibilities of chemical laboratory methods. Also quantities so small as to be far beyond the possibilities of detection by the chemist are not only detectable but are measurable by the methods of quantitative spectrography.

Interesting optical instruments for the shop, making use of the above principles are described and illustrated in this and following articles.

One of these, the toolmaker's microscope, provides a means of carrying out small-scale work with speed and accuracy. The work appears 42 times larger. A special protractor eyepiece and micrometer screws in the stage permit one to carry out accurate measurements of lengths or angles, to lay out fine work, or to inspect work.

The protractor eyepiece—one of the most important features of this microscope—makes it easy to lay out or to determine angles in small work. The eyepiece has two interrupted cross lines mounted so that the angle between them can be changed from 40 deg. through to 70 deg. by turning the eyepiece. A graduated scale is visible with the interrupted lines in the field of the microscope and shows the angular relationship between the two lines to an accuracy of 20 min. of arc. On the outside, around the eyepiece mount, is a drum scale graduated 180 deg. to 90 deg. on either side of zero with a double vernier reading to 1 min. of arc. The outside scale and vernier are observed through a magnifier and mirror located just above the eyepiece end of the microscope. This equipment affords an excellent method of checking screw threads.

The helix angle of a thread can be read very easily. For example, the protractor eyepiece cross lines are adjusted for the visible flank angle of the thread profile; and then the angular setting of the protractor eyepiece, read on the outside circle, represents the lean of the thread. This instrument is also used for measuring the lead pitch diameter, outside diameter, crest diameter and root diameter of a thread. It will be noted that all constants of a screw can be measured including flank and helix angle, not so easily measured by other than



Light from the object passes upward through the objective lens, then through the correcting prism, inclination prism, protractor disk, and eyepiece lens

optical means. Often a screw having an erroneous flank angle or a helix error will pass inspection when tested with a female gage, but no such error will escape measurement with the toolmaker's microscope. All of the measurements are made quickly and to a high degree of precision.

Linear measurements up to one inch are made directly with micrometer screws, which operate the stage in two directions at right angles to one another, and read to 0.0001 in. Lead and the pitch diameter of screws and taps can be measured directly. The operator focuses his instrument on the contour of the thread, moves the flanks of the thread to coincidence with the interrupted eyepiece lines and takes a reading. He then moves the stage by means of the micrometer screw to bring the opposite thread groove flank to the cross hairs and takes a reading on the same micrometer drum. The difference between the readings is the pitch diameter. Measurements can be made by means of standard gage blocks instead of the micrometer screws if preferred.

A feature of importance to the toolmaker, who is not usually familiar with the laboratory microscope, is the fact that in observing a tool in the field of this instrument, its movements are not inverted or reversed as in the laboratory microscope.

Equipment is available for adapting this microscope to specialized work. Vertical, oblique, or transmitted light may be used to illuminate the work; each kind of illumination may be used to advantage on some particular kind of work. And different optics can be used to get higher magnification when necessary.

The uses to which the instrument has been put should suggest many possibilities in the tool room and inspection department.

In motion picture film production the position of the perforation and sound tracks are measured and must be accurate to one ten-thousandth of an inch. The slit through which the sound track on the film is illuminated must also be accurate and several measurements are taken on the toolmakers' microscope to be sure.

General inspecting of small contours is often most convenient on this type of instrument. Toolmakers' microscopes are used for checking the accuracy of the dies used for drawing wire. Rayon spinnerets are examined for the position and size of the hole through which the viscid material passes. The tools for making the holes in the spinnerets are also examined.

Irregular parts for adding machines, watches, also small gears, dental burrs, etc. are measured and examined; and the angle of the bevel of the safety razor blade cutting edge is checked by the use of this microscope. It is an instrument of laboratory precision but is designed to stand the rigors of shop usage.

The first of five articles.

NEW BOOKS . . . . . .

PERSONNEL PROBLEMS.—*By Felix E. Baridon, General Accounting Department, and Earl H. Loomis, Personnel Department, Western Electric Co. 452 pages, 5¾ x 9 in. Clothboard binding. Indexed and illustrated. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $5.00.*

The wide variety of problems connected with that phase of management which deals directly with personnel is set forth in this volume. The problem method of presentation is employed—that is, at the head of each division, the specific phase under discussion is stated.

Some of the topics receiving attention are employment, remuneration, maintenance of working force, employee progress, payment for absences, health, safety, and working environment, employee relations, and centralized personnel control.

Readers unfamiliar with the intricacies of personnel management will undoubtedly gain clearer perspectives of this many-sided subject. To those experienced in personnel work, the volume will be less valuable chiefly because, though the problems are clearly presented, little effort is made to solve them.

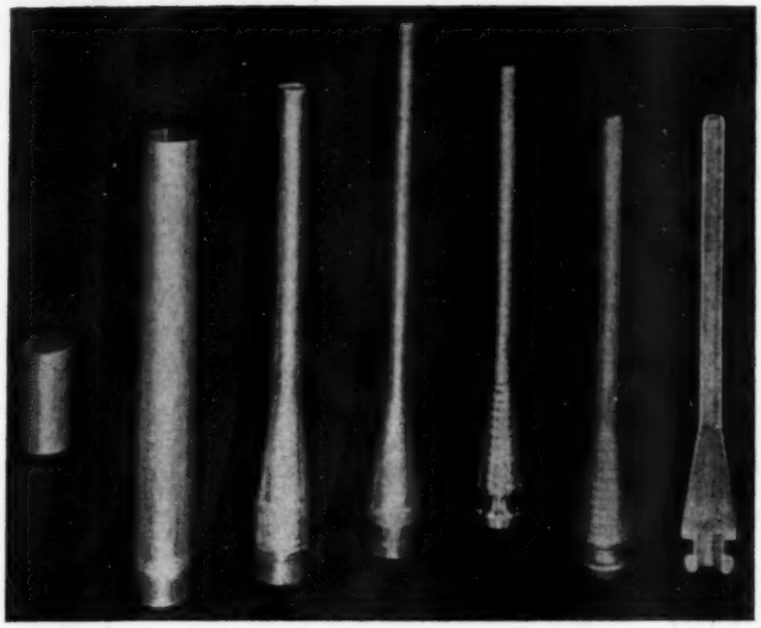
MECHANICAL DRAWING, Books I and II—*By Horace E. Boggy, Head of Drafting Department, Arsenal Technical Schools, Indianapolis, Ind. Pages 8½ x11 in., Book I, 48; Book II, 32. Paper covers. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $0.60 each.*

These are flexible texts, consisting of groups of practical drawing problems, each group being the same in principle but graduated as to difficulty. Four problems are provided on each sheet, thus permitting the instructor to assign problems of greater difficulty to more exceptional students. Another innovation is the inclusion of pictures and drawings of modern mechanical types, such as automobiles, airplanes, and locomotives, with questions and sufficient design data to excite the interest of the student and to aid him in orienting mechanical drawing in relation to design and engineering generally. These books are the first two of four, each covering a semester's work.

Exceptional in this set is the obvious effort to have the student understand what the piece is that he is drawing, and to aid him in realizing why he is making the drawing and what purpose it must ultimately serve. This understanding, had it been achieved by earlier drafting students, might have aided in eliminating much of the present bickering between drawing room and shop.

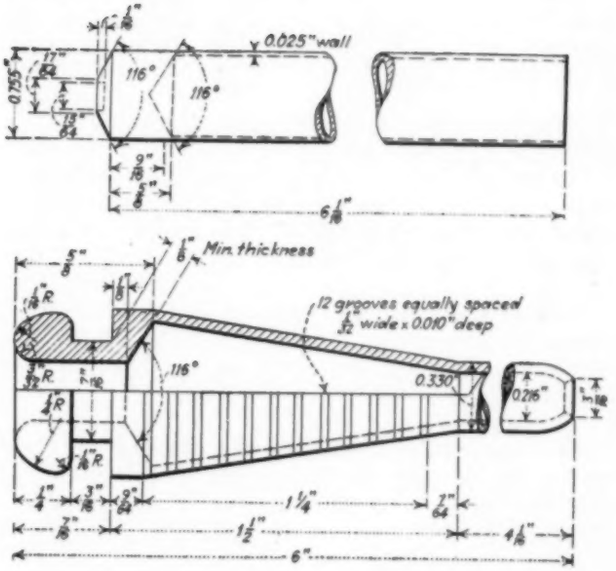
ELECTRICAL MAINTENANCE, A Unit of the Instruction Manuals for Auto Mechanics—*By J. A. Roenigk. 107 pages, 8x11 in. Indexed. 114 illustrations. Paper covers. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $1.25.*

One of a series of automobile maintenance manuals, the purpose of this book is to present a general guide to proper methods and correct procedures in the maintenance and repair of starting, lighting, and ignition equipment. Instead of giving specific instructions for any particular make of automobile or any single piece of equipment, the reader is referred to auto-electrician's manuals and the manufacturers' specifications for exact data on clearances, timing, and the various adjustments in each case. Instructions are given in testing circuits and locating troubles in various hook-ups, but no attempt is made to cover the complex field of trouble shooting, which is to be handled in another book of the series. The many illustrations lend clarity.



The blank, the finished quill and the operations in between. From right to left: the blank cut from the rod, the extruded cylinder, the first and the final swaging, the turning and drilling operations on the large end and finally the finished quill. The half quill at the extreme right is for the purpose of checking the wall thickness in the preliminary development work

Bobbin Quills by an Unusual Method



Drawing of the quill showing the dimensions of the blank, extruded tube and the finished quill

WITH considerable ingenuity, a piece of aluminum rod can be made into a light, hollow quill. This quill is used in textile mills as an arbor upon which yarn is wound. To date, it has found its principal application in the silk industry and in connection with electric feeler stop mechanisms. The non-splintering qualities of the metal quill eliminate the need for frequent refinishings and make its first cost practically its last cost. Its life is that of several wooden quills.

The rod blank from which the quill is to be fabricated is cut to length on an automatic screw machine and then annealed. The annealed blank is extruded into the form of a cylinder with about one-half inch of the bottom left solid. This is done in much the same manner as collapsible tubes are produced except that the blank consists of a cylinder blank instead of a flat disk punched from sheet metal. The extruded cylinder has a solid base and a wall thickness of 0.025 in. As the lengths of the cylinders vary after extrusion, it is necessary to trim them to uniform length.

Two swaging operations form the taper and reduce the diameter of the hollow cylinder to its final size. After the base has been drilled and turned and the tapered portion grooved, the upper end of the quill is cut to length. This end is then spun in or rounded and the quill scratch brushed to remove burrs and to round any sharp edges. The final operation is a caustic dip finish.

Between each of the operations, the quills are carefully inspected in order to insure dimensional accuracy and uniformity of product.

The cross sectional view shows how the metal is gradually thickened on the taper part and uniformly thickened on the straight quill part. The operation as a whole is an interesting example of the flow of metal: from a solid bar it is transformed into a large tube with thin walls, then changed to a small tube with thick walls. Notwithstanding the violent mechanical changes, the metallic structure in the final shape is stronger and tougher than in the original bar.

EXECUTIVE

Rainbow's End

The time was when efficient tools and a comfortable place to work were considered the only requisites for a good day's work. But lately, the workman's surroundings have received a great deal of study. Distracting noises have been outlawed, and in some instances, music has been substituted. Now color comes in for careful analysis. Are such factors of prime importance in shop operation? Or is their effect so small in proportion to other influences, affecting output more directly, that they may be neglected? What do you think?

IT WAS just 10 o'clock when Bert Jennings, Works Manager of the Express Machine Company, dropped into the chief engineer's office. This morning call was almost habitual and was timed for a definite purpose. Ralph Cary well knew that purpose, but with customary engineering perversity, always made Jennings ask for the information he wanted.

"How's everything this morning?" Jennings asked.

"Feeling fine, thanks," said Cary. "How're you?"

"You know darn well I'm not interested in your health," said Jennings. "Have you received the morning's mail, and did we get any new orders?"

"Let me see," said Cary with exasperating deliberation. "Oh yes, here's an order for two milling machines. And when you get it in the shop, read the footnote carefully. The machines must be painted orange."

"Orange?" exclaimed Jennings. "Where are they going? To the repair shop of a marmalade factory?"

"No," said Cary, "to the Simplex Steel Company. And you're to submit a sample of the paint to the customer to be sure you have just the proper sunkissed shade."

"But what's the big idea?" asked Jennings.

"Color psychology," Cary explained. "Even you must know that all our thoughts and actions are influenced by environment—noise, heat, light, vibration, and color all have their effect."

"Maybe we should paint all our machines orange," suggested Jennings. "They might set up the proper vibrations in the customer to make him buy them by the dozen."

Nothing daunted by his friend's interruption, Cary continued, "Orange has an extremely high visibility. Machines painted that color will brighten the shop, and among other benefits, prevent accidents."

"Then it looks as though the machine tool builders were all wrong when they adopted blue-gray as standard," said Jennings.

"Not necessarily," said Cary. "Machines are furnished with the standard finish when no color is specified, but the customer still has the deciding vote. Equipment cannot be considered alone but must contrast with the work and harmonize with the color scheme of the shop."

"Still more interesting," said Jennings. "And what will be the setting for the orange millers?"

"Blue, green, and white," said Cary. "Blue will reflect the ultra violet rays, green will supply the energizing component, while white will brighten the shop and promote cleanliness. The main idea is to keep the workman in a cheerful frame of mind and thus increase production. Sombre colors depress the spirits and induce fatigue and careless habits."

"At first I thought you were just rubbing it in because you knew I had to repaint all my stock parts," said Jennings, "but I believe you're hipped on this color scheme yourself."

"So I am," admitted Cary, "and you'd be too if you'd forget some of your antiquated ideas. These things I've told you aren't just theories. They're based on actual tests worked out in psychological laboratories. It's been proved that men work faster and tire less quickly when surrounded by the correct color combinations."

"Excuse me," said Jennings, "but I have to run downtown and make an important purchase."

"What's so important all of a sudden?" asked Cary.

"I need a pair of rose-colored glasses," said Jennings.

FORUM

Discussions Of Former Subjects

Marking Time

No experienced business executive has been holding back programs willingly and the few who are deferring release dates are victims of present conditions. No company can really profit by holding back release dates until prosperous times for the following reasons:

(a) A new article is not ready for big production such as is called for in prosperous times until it has been through the mill.

(b) During busy times, manufacturers do not take time to try out new articles of unproven merit.

(c) Sales are smaller during a depression, and this gives the manufacturer an opportunity to thoroughly develop his article and really be in production when the swing starts up.

The fear that some competitor will jump in and take advantage of a new design is mostly imaginary, as the only manufacturers who resort to these methods are so small and half asleep that the progressive man need have no real fear.—C. F. STAPLES.

Buy Design?

The demand by a customer for detailed drawings of all the component parts of a purchased machine is not justified. Any such demand or even suggestion should be rigidly opposed by the manufacturers. The customer is fully entitled to any details or particulars which facilitate the proper working of the machine, but details of design are the property of the maker. It is possible for any customer, after purchasing a machine, to pull it to pieces and make drawings of its parts. As the machine is his own property, no objection can be made. The dismantling, drawing, assembling, and inoperative time of the machine, however, represents a considerable outlay, and this outlay is the price that the customer has to pay for the detailed knowledge obtained.

There may be some truth in the argument that the purchase price of the machine includes part of the cost of the design, but the actual machine is sold with the idea of its accomplishing certain specific work and not as a concrete example of design. The demand for comprehensive details is therefore wrong and can only be justified where the customer is prepared to purchase the patents and absorb the whole output of the manufacturer.

—A. WILLIAMS, *Chief Estimator, Bristol Motor Constructional Works, Bristol, England.*

Brain Fag

In setting rates under all modern time-study systems, a percentage is added for relaxation, the amount of which is determined by the nature of the work. In our shop, we have no definite rest periods, but the men are allowed to smoke one-half hour in the middle of the morning and one-half hour in the middle of the afternoon. This tends to break the monotony of a four-hour stretch, while still keeping the men in their appointed places. To allow a definite time for rest means far more lost time than can be accounted for. This is caused by clock watching and deferring the starting of tasks when near the beginning of the rest period. A simpler way is to let the men understand that they have a certain allowance for relaxation and leave it to their judgment as to how they will distribute this allowance.

—W. A. WALTER, *Purchasing Agent, Pneumatic Scale Corporation, Ltd.*

Misguided Loyalty?

If a person is of good moral purpose and integrity and true to himself, it necessarily follows that he will not only be loyal to the firm, but to his fellow-workmen also. Hence the necessity of securing men of high moral character for positions of authority, so that persons subordinate to that authority may feel secure in placing what they conceive to be their just complaints before them. When a manager or superintendent has recourse for information from men in subordinate positions regarding their immediate superiors, he is neither just to the firm, the person questioned, nor the person in question. —FRED KAY.

Promising Performance

A written guarantee prevents the vendor from submitting over-optimistic production figures in order to clinch the order. On the other hand, the executive of even a high-grade concern might blame the vendor if he cannot achieve the output he promised his superiors.

The vendor should not make a selling point of written guarantees, but offer one if insisted upon only after an agreement has been reached in regard to operator skill, tool design, and uniformity of material. Even then an approximate output should be promised, for it must be impressed on the customer that only one factor is supplied by the vendor, namely, the machine. This idea will not work if the salesman is not reasonably sure of the man he is dealing with.

—FRED M. LINDAHL.

Dealer or Direct?

That dealer selling is less costly than direct is generally granted, particularly at a time like the present. When business is booming, direct selling may show the lower unit sales cost. Granting the lower unit selling costs for dealer distribution at present, the true economy is still questionable. A plant running at considerably below production capacity, has a unit manufacturing cost which is high because a relatively fixed overhead which is distributable over fewer production units. Increasing the production by direct selling, may well bring about a higher unit selling cost; but it may also bring about a lowering of the manufacturing cost by the distribution of the fixed overhead over a greater number of units, resulting in a real net economy. Anyone who has had experience in interviewing dealer salesmen and direct salesmen in the quest for information, realizes that the dealer salesman is

often a disappointment. If you can read the catalogue or other descriptive matter the dealer salesman has in his possession, you often know as much about the product as he does. The direct salesman, by contrast, is generally equipped not only with full technical information, but likewise possesses an experience that is decidedly helpful in selecting or adapting the model most useful for your work. He often digs up uses for his product through his intimate detail knowledge, not only of his business but of yours, that spell greater orders for his company. —N. RICHARD.

Come Seven?

Short hours are more of a sedative than a cure. What we must have is not shorter hours, which mean curtailed effort, but an ever-increasing market for our products. High wages have produced in America the largest home market the world ever knew. Would not a systematic raising of the standard of living have kept our home market undisturbed? Had Europe followed this method would it not be less dependent on foreign consumption? Why can't our leaders develop the markets of Europe and the Orient? There the needs are sufficient to keep all hands busy far into the future.

—FRED A. PATTERSON.

Friendliness or Aloofness?

Friendliness with employees is highly desirable and something I myself like to foster; but professionally, I have found that it is not generally advisable. The average executive, if he has the time, would like to be interested in those who work under his direction, and to some degree extend this interest outside of the shop or office. The executive wants to do this out of sincere unselfish interest, without thought of return in shop or office efficiency; but I doubt if many find that the employees will reciprocate in kind. Too often the employee's reaction implies at first that he suspects the selfishness of the advance; after accepting it in its proper spirit, he feels it grants him privileges he would otherwise not rate.

So it is better to restrict human interest to the shop or office proper, and not extend it outside, where there is always a possibility that a wife or mother will ask the special consideration that the man himself will realize is out of order. It is conceivable that in a small town, this attitude must of itself be modified to some extent; but in a large city at least, it is advisable to remain aloof outside the shop.

—ELI SMITH, *Engineer, Russell & Company.*

Who Buys?

When the three distinct divisions of sales, financing, and manufacturing are each under a separate major executive, purchasing would naturally come under the manager of manufacturing. When a general manager supervises sales and financing as well as manufacturing, the purchasing department should be accountable direct to him. In other companies, it should have no superior except the president.

There is no department in an industrial plant qualified to handle purchasing save the purchasing department itself. Engineering should be the last to have control of purchasing. The engineering department is constantly changing the product and is vacillating between undeveloped ideas and can give neither engineering nor purchasing the proper concentration when burdened with both.

The most successful method I have seen required the purchasing agent to determine first whether our business would be an important factor in the vendor's business and the financial standing and stability of the vendor. Last of all came price. To prevent any temptation to unfair practice neither the purchasing agent, nor anybody else in our company could own stock in any source of supply. —E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

Inducing Ideas

Instead of troubling about artificial incentive schemes, let the engineer in charge of the drawing staff think out some natural incentive. It won't be long before he discovers the output of his department wonderfully improved not only in quantity but in quality. He can raise the pay of nearly every member of his staff and get output at least proportionate to the raise in a very simple manner.

Suppose that each man were always engaged on the highest class of work of which he is capable, instead of on work of mixed quality. Obviously, each man would earn more and therefore be worth more. Output would be greater for the simple reason that men always work best on the things in which they are interested. A high grade designer rarely makes a fast copyist. Not only is it possible to skill-apportion the jobs, but the elements in the jobs also. Put the high grade man on the highly mechanized parts, the medium grade man on the simpler mechanisms, the low grade on the non-mechanized parts. Success has been achieved in a few instances by differentiating between invention and design. The man who can evolve new principles is an inventor and is almost as rare as the black swan of tradition. Yet many such men are employed putting down lines whose length and position are determinable by simple draftsmen. With each man engaged on the highest grade work of which he is capable, the company will be well able to pay real incentive-bearing salaries. Part of the incentive lies in the men's knowing that their energies are profitably and not wastefully absorbed.

—FRANCIS W. SHAW, *Consulting Engineer, Heywood, England.*

An incentive for designers is right in principle, but the application of the principle is one of exceptinoal difficulty. The net value to the company of an idea or of any particular design depends on factors in addition to those of the excellence of the design and its economy from the production standpoint. Also the value is frequently ascertainable only after the lapse of many months. The best inducement to designers is the knowledge, that if they produce designs which are consistently good and paying, they will get a substantial increase in salary and a particularly brilliant piece of work will result in a letter of thanks accompanied by a check from the president. Of course, this is of value only if credit is given where credit is due, but on the other hand, there is certainly no mechanical method of ascertaining the value of a designer's work and rewarding him in some equally mechanically perfect manner. —H. J. BURNHAM, *Birmingham, England.*

Refinements in Die Practice

C. V. DORER
Chief Tool Designer,
White Sewing Machine Company

NO DOUBT most of us have noticed in recent years the tendency of general manufacturing towards sheet-metal construction. In the years to come there will be a still greater tendency as production methods become more highly specialized.

We make a variety of articles besides sewing machines, and have, naturally, felt this trend. With competition as keen as it is today every ounce of metal and every penny of die cost must be taken into consideration. Excess operations must be eliminated and handling reduced to a minimum. Combination dies of various kinds play a very important part in this economy.

In handling a press job there are a number of items which must be given individual consideration.

We must consider the total quantity per order to be made, and the amount of individual runs, as well as the eventual total amount to be made. These are important factors; thereon depends the buying power of the purchasing department; thereon also depends the selection of the equipment with which the job is to be made. Short runs require a different type of equipment than do long runs. Set-up is the determining factor. If the quantity of parts is small, narrow widths of stock for single-run dies will no doubt be used, but if the quantity is large, say 50,000 or more per run, it is advisable to look into the possibilities of double and triple runs. As a rule, such runs will bring about a reduction in labor and material cost but will increase the tool cost, which will be our second item.

Original tool cost and maintenance of tools are the second factors in the price scheme. Most concerns today want lot prices on parts and are not interested in the tools or their upkeep, the paramount factor being the cost of the individual piece ready for delivery. It is at this point that the designer of dies must use his ingenuity, designing his dies in such a way that they are easy to operate and set up, at the same time keeping down their original cost and subsequent upkeep.

When spreading die costs over a quantity of pieces, one will readily see that the initial cost is not always the greatest. A set of dies costing $500.00 spread over 1,500,000 pieces amounts to 33 cents per 1,000 pieces. A very few dollars, say $50.00, added to our $500.00 would raise the 33c. to 36c., but might avoid a lot of die trouble, double the length of the runs, and in the end pay a substantial profit. Cheap dies do not always mean an inexpensive product. Very often the saving in die cost is lost in overhead and other intangibles such as minor repairs, loss of production and scrap. A careful check-up on these items sometimes shows surprising results, and jobs which were thought to be profitable are actually shown to have been done at a loss.

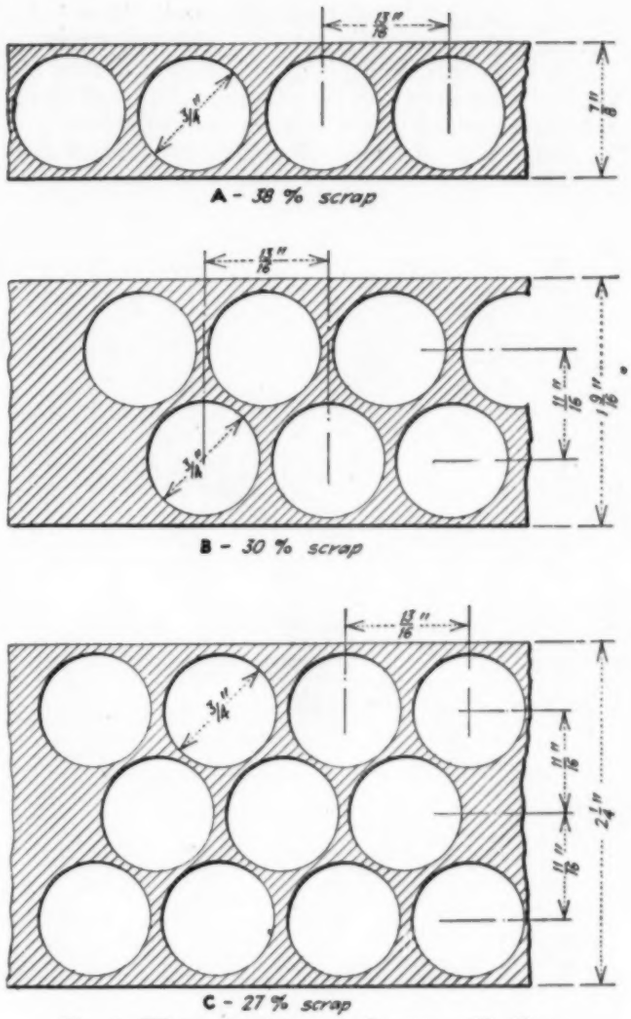


Fig. 1—Where the shape of the part will allow, there is considerable economy of material in multiple punching

In buying material for press parts, the wider the stock the less it costs. Handling charges are less all along the line and the amount of scrap is less. Fig. 1, while showing a simple job, serves to illustrate the point.

The triple run leaves only 27 per cent scrap, and from the material standpoint, is the most economical. But we must be governed by the die cost spread over the lot to be made, and this method requires the most expensive die.

However, should it prove an economical thing to do and should the shape of the blank permit, the strip of stock can be run three times through the die, the material savings and die savings being effected at the expense of operating labor. Each case must be decided on its own merits.

Next we consider the type of equipment the job is to be made with. Here, as a rule, we do not have much choice. Most plants are already equipped along certain lines, and while the equipment does not always exactly meet the requirements, unless funds are available for new equipment, that on hand must be used. If high-speed presses with roll feeds and scrap cutters are available, great inroads can be made in labor costs on the first

operation work. In second operation work, dial and slide feeds are labor savers.

This is the item which is causing a great deal of discussion. In many plants a great deal of time and energy is being expended to get the most productive tool for the least amount of money. Note that this does not mean the cheapest die to produce a good piece. This is where

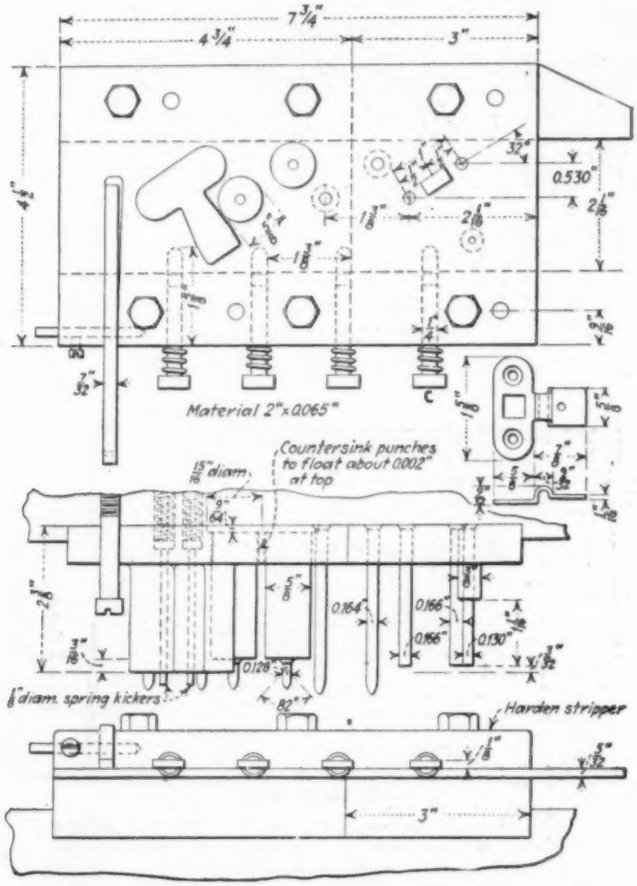


Fig. 2—A machined countersink is not satisfactory in thin metal. By displacing metal the punched countersink removes some of the objections

a good many of us fail. We see original cost only and realize when it is too late that we were penny wise and pound foolish. A die should be well built and substantial, but fancy work such as surplus grinding, polishing and trimming-up is needless expense and makes no profit. In this connection, combination or follow dies are being employed to a large extent and with excellent results.

Most of the dies here illustrated produce complete parts at each stroke of the press and have cost practically no more to build than would two or three dies, had the various operations been separated. Such dies require some real forethought and designing, but results are always a source of satisfaction.

The dies shown in Fig. 2 are combination pierce, countersink, and blank dies. Most jobs of this nature are pierced and blanked in a die and then countersunk in a drill press or special machine built for the purpose. The dies shown will do a first-class job and leave a flat blank. The countersinking punches should be as large as possible in order to strike as much of the surface of the stock as possible and flatten it down around the holes. It is advisable to let these punches float slightly, making

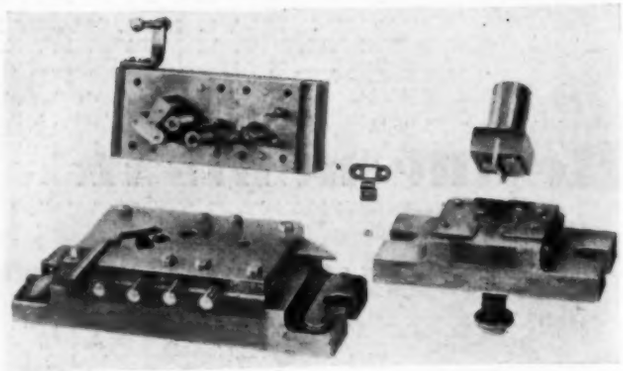


Fig. 3—The first and second operation die for the part shown in Fig. 2

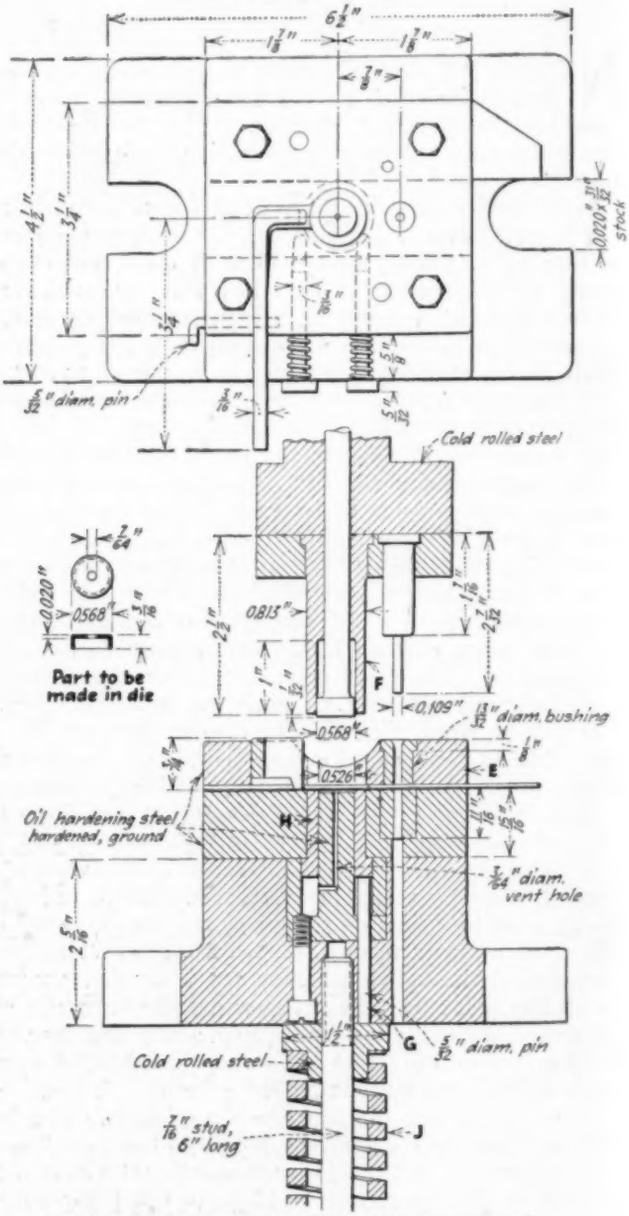


Fig. 4—Just an extra little hole, but second operations double the labor cost, at least

their shanks in the punch pad about 0.001 or 0.002 in. smaller than the holes in which they fit. If this is done there is no tendency to distort the stock, and a neat, even countersink is obtained.

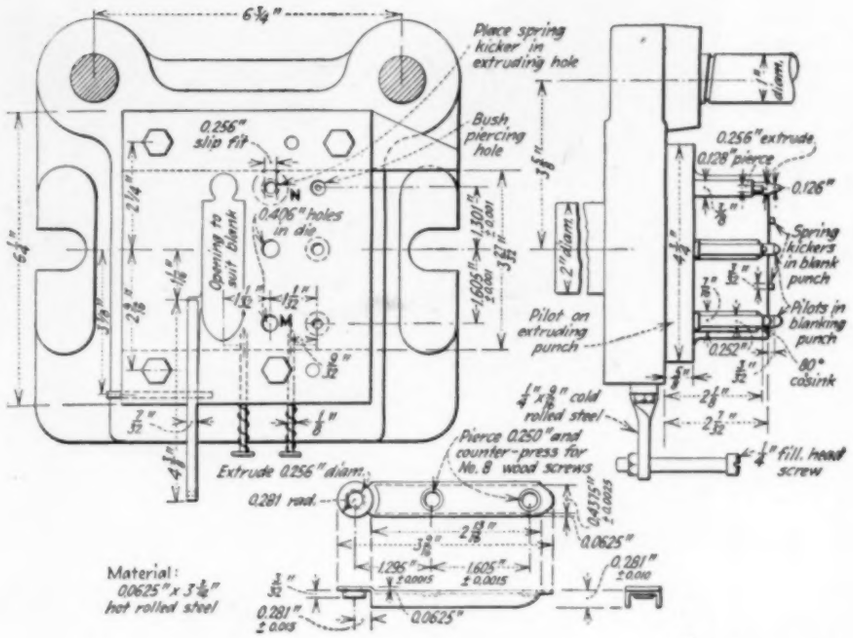


Fig. 5—A steel part that includes both countersinking and extruding

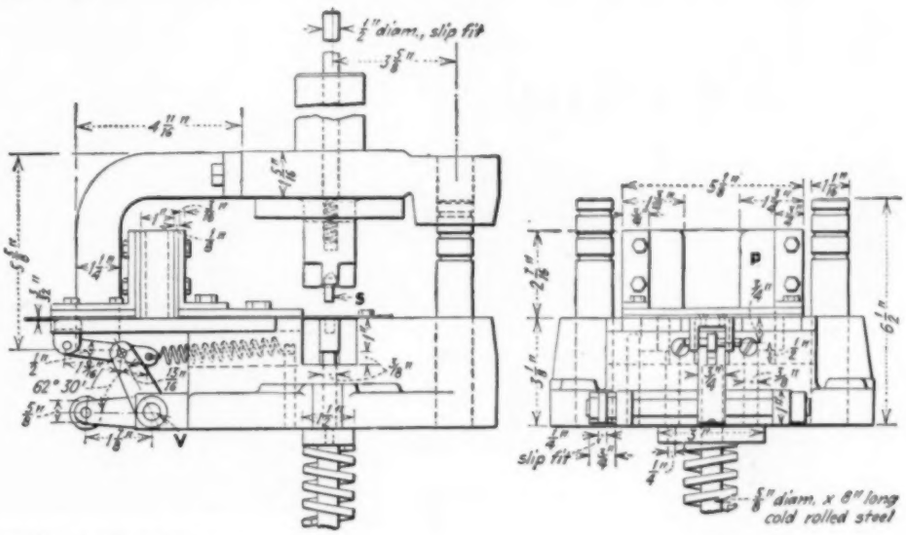


Fig. 6—Die with self-contained slide feed and blank holder

It is important to use exactly the right diameter of piercing punch, since the stock on the upper side of the blank must flow under the countersinking punch, and if there is too much material in the hole, it will leave a fin around the underside of the countersunk hole. It is also apt to snap the pilot off the countersinking punch. Push fingers *C* are used to facilitate getting the strip started in the die. This die operates at 112 strokes per min. The second operation die is a simple die with pressure pad to form and flatten the part, production being about 1,300 pieces per hour. If the production is large enough, the second-operation die can be equipped with a slide feed so that a part can be formed at each stroke.

The die shown in Fig. 4 makes the cap with the hole in it, producing it from coil stock at the rate of 90 pieces per min. This die is built with a hardened stripper plate *E*, the punches being guided in the stripper, thus eliminating any chances whatever of shearing the die.

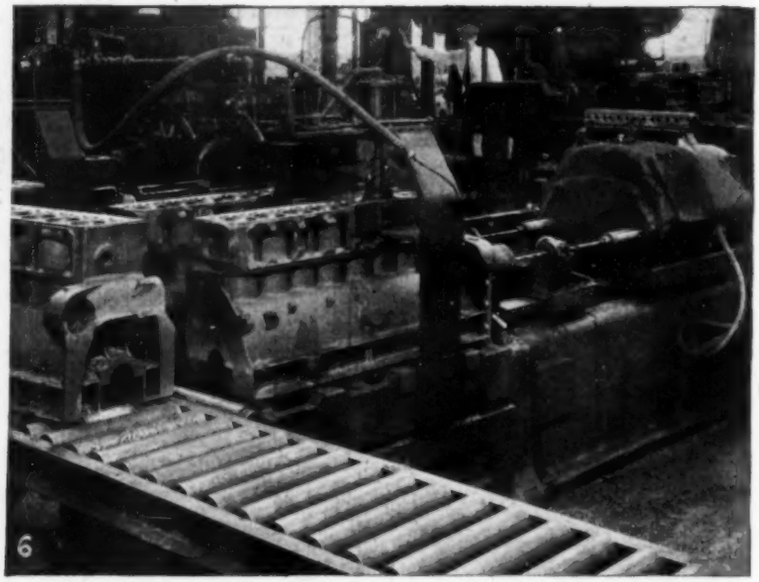
This job is run in an inclinable press, air being used to blow the part clear of the die when it is ejected from punch *F*. Pins *G* support the pressure pad *H* against the action of spring *J*. The press selected for a job of this type should have enough stroke to permit the punch to clear the stripper by at least 1½ in. on the up stroke, if fast operation is desired.

The carrier hinge plate illustrated in Fig. 5 is a two-operation job. The first die is a pierce-countersink, extrude and blanking die. In this case the countersinking is accomplished by forcing the metal down in the die at *M*. This method does not leave the blank with a flat back, but can be used when this requisite is not necessary. The extruding is done at *N*, the proper size hole having been pierced to give the required height to the extruded part. The first operation die operates at 112 strokes per min.

The second operation, Fig. 6, is of the automatic feed type, the feeding mechanism being operated with a bar *T* attached to the punch-holder casting. The blanks are stacked in blank holder *P* and are shoved forward into position by slide *R*. One piece is formed at each stroke of the press. The press operates at 34 strokes per min. The parts are stripped from the punch by ejectors *S* and blown from the die by compressed air. It is advisable with feeding mechanisms of this type to have a shearing pin such as that at *V*. Occasionally something will go wrong and when it does this pin will shear off and avoid smashing some part of the mechanism.

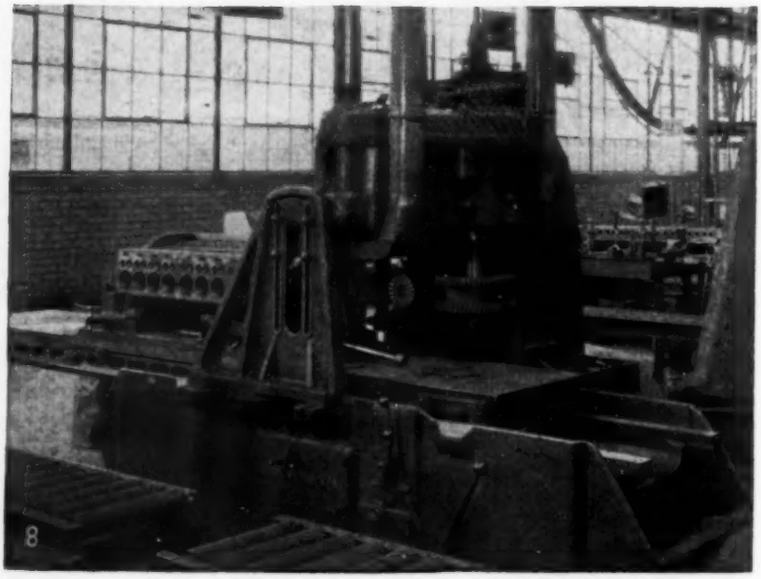
All these dies have been in operation for some time and are producing first-class pressed-metal jobs. Dies such as those should be built with care and precision so that all parts line up and function perfectly, nor is it advisable to stint on the quality of material used. The best is none too good if long runs and quality production are desired.

[6] Oil holes are drilled clear through the block, half from each end, in a Barnes long hole drilling machine using Oilgear feed. The machine is set at right angles to the main conveyor, and the blocks are shunted off until drilling is completed, a typical set-up for operations performed from the block ends



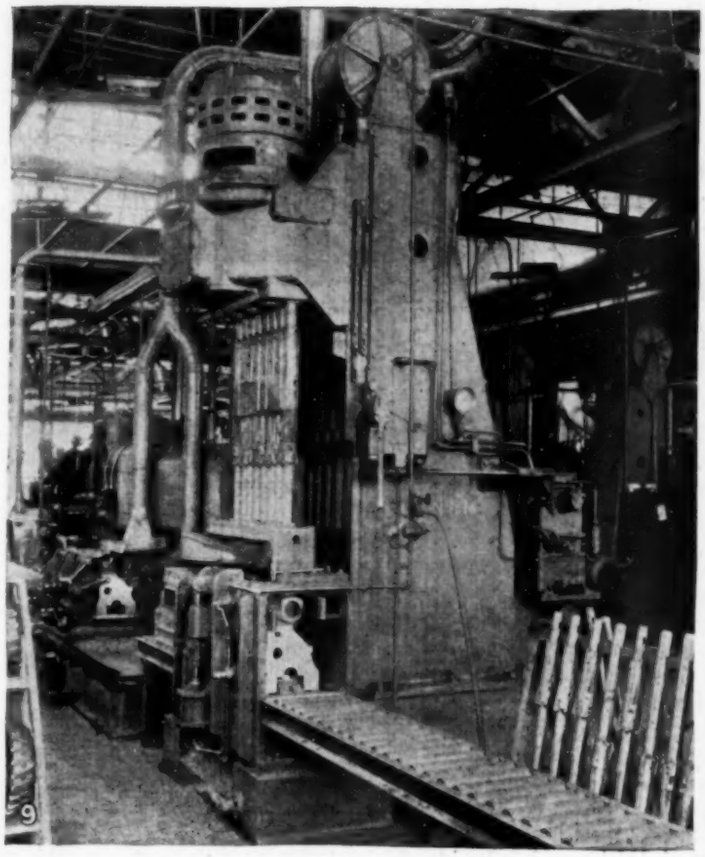
A New Line on Cylinder Blocks

Some of the ingenious fixtures employed by Chrysler to machine the Imperial Eight block are shown in this second and concluding set of selected views



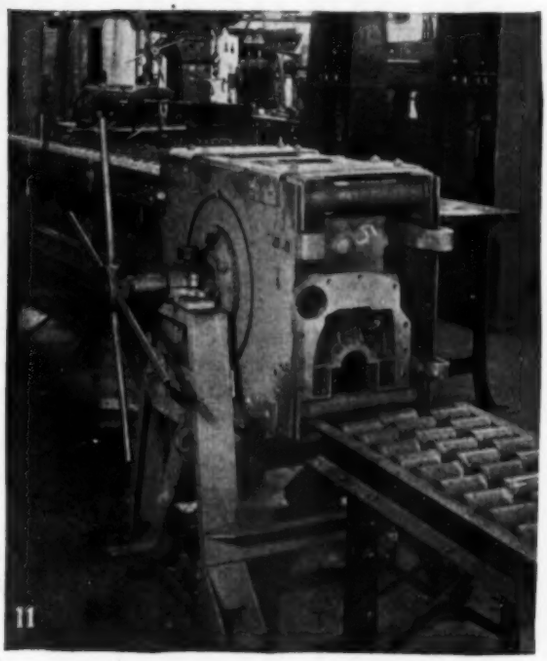
[8] The block must be laid on its side to mill the bearing grooves and manifold faces in a Kearney & Trecker machine having three vertical and one horizontal spindles. The work is removed from the conveyor line by an air hoist for this operation

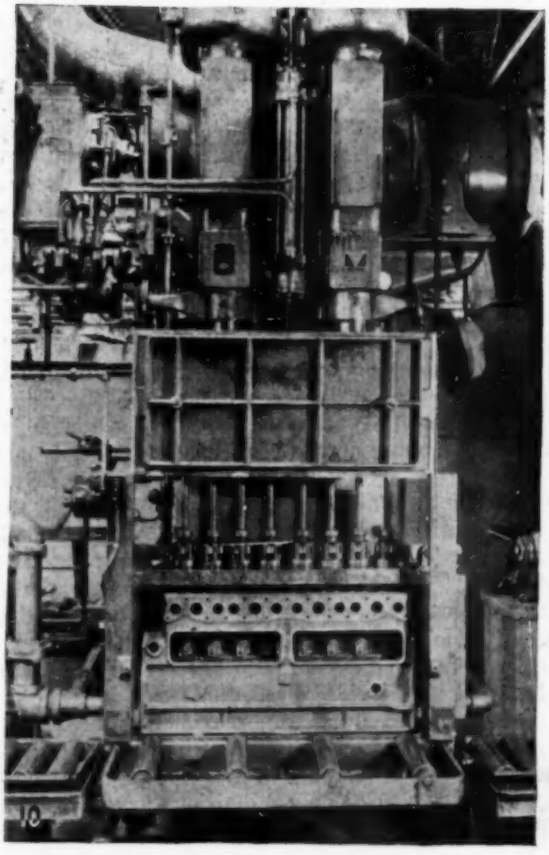
[7] A Barnes special horizontal drilling machine, the bed of which straddles the conveyor, bores the main bearings and camshaft holes. The work is lifted hydraulically against flat locating pads during the cut



[9] Eight cylinders are semi-finished and finish bored simultaneously. Note the air clamping, tunnel type fixture, built into the machine and around the conveyor. This eliminates the former practice of pushing the casting sideways into the machine which interfered with continuity

[11] This is one of the turnover fixtures used in the line; many other devices are employed to keep the work moving without heavy lifting





[10] Entirely submerged in kerosene, the cylinders are rough lapped in a Barnes machine. This controls the temperature and consequently bore sizes within close limits. A similar machine does the finish lapping in a subsequent operation

THE conveyor for the Imperial block line passes five times across the shop, forming loops, two of which contain nearly all the machine tools. The other loops serve as aisles in which the operators work. For only a few operations is it necessary for the men to step across the conveyor line and then only through gaps left for the purpose. On most machines, the controls for tools and clamping jigs are reached from the aisles, many of them being extended to the operator's position.

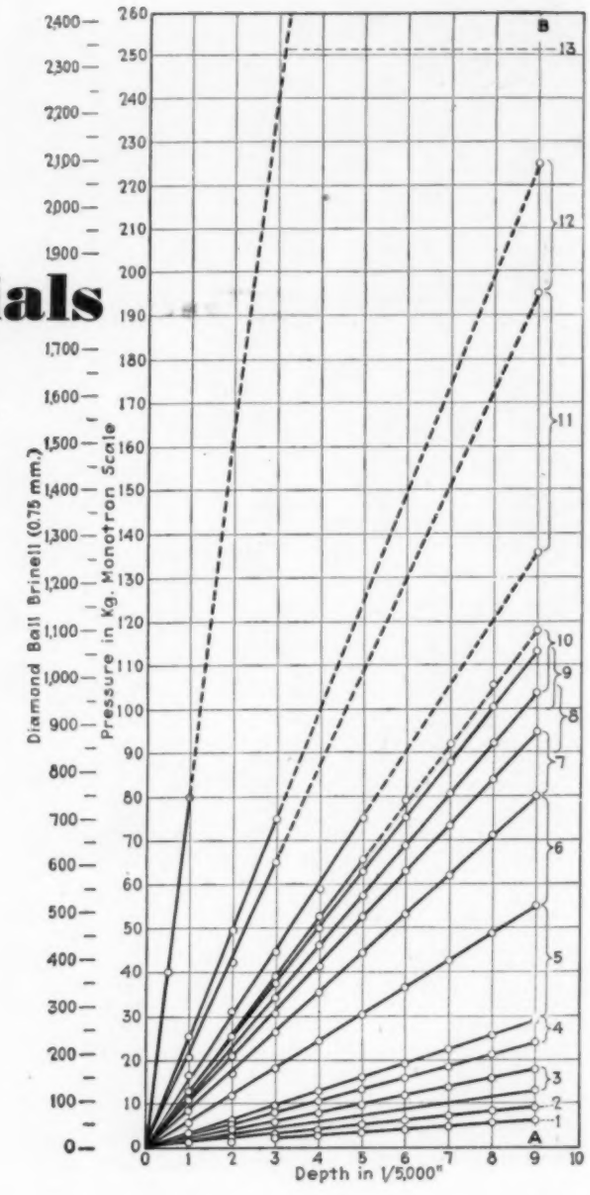
Sufficient cylinder blocks for a day's run are readily stored at the start of the line adjacent to the unloading dock where all materials enter the shop. From this point to the end of the line, every facility is provided to insure quality, convenience, and economy of operation.

Hardness Testing Superhard Materials

A. F. SHORE
Shore Instrument & Mfg. Co.

WITH the increasing use of nitrided steels and the tungsten and tantalum carbides, quality control demands routine hardness testing. Most important among the difficulties arising from the superhardness of these materials are the hardness limitations of the indenter point and the necessity for obtaining an indication of hardness below the immediate surface. The diamond ball Brinell test is, however, practically a laboratory operation, because a polished surface is required to obtain an accuracy commensurate with the microscope readings. But tungsten carbide is exceedingly hard and usually has a slightly porous surface that makes polishing difficult. With nitrided steel the margin of the test indentation is usually indefinite because of chipping that causes a greater penetration than warranted by the actual hardness of the case. In addition, there is a considerable variation in hardness with the depth. A typical specimen showed a Brinell of 1002 at the surface, 810 at 0.010 in. below the surface, 434 at 0.020 in., and 378 at 0.030 in. Therefore, in testing the carbides and nitrided steels, it is necessary to apply a test that will disregard immediate surface conditions and take a reading slightly below the surface, and in addition obviate chipping of the latter material.

On hardened steel the usual Brinell penetration is usually not more than 0.002 in. On tungsten carbide, the penetration is so slight as not to give a satisfactory reading. In the Monotron test, this difficulty is obviated by causing a definite indentation with a $\frac{3}{4}$-in. diamond indenter and observing the load imposed. When the microscope depth units are plotted on a chart against applied pressure units, such as in kilograms, the datum points fall in a straight line. The instrument is regularly graduated in 1/5000 in., while the pressure scale is graduated in pounds, kilograms or Diamond Ball Brinell. In hardened steel and softer metals, a penetrational depth of 9/5000 in. has been adopted as standard. The standard penetrator is a hemispherical diamond, the diameter of which is $\frac{3}{4}$ mm. To penetrate this depth in hardened steel requires from 100 to 115 kg. If the value is 100 kg., and it is divided by 9, the result is approximately 11 kg. for each 1/5000 in. of penetrational travel on the micrometer. If on the finished surface a 9/5000-in. penetration is considered objectionable or a destructive test, a penetration of only 3 divisions may be taken, requiring a little more than 33 kg. Thus, if the load value indicated is multiplied by 3 after taking only $\frac{1}{3}$ penetrational travel, the standard hardness of the specimen is found. With this method it will be seen how superhard material may be tested safely with the diamond by taking only part penetration. Applied to a specimen of tungsten carbide of average hardness, a reading of 65 kg. would be obtained for penetration of 3 depth divisions, or about twice that for hardened steel. The value is multiplied by 3 and gives a total resistance of 195 kg. or 1800 Diamond Ball Brinell, as shown in the accompanying chart.



Plottings of the part penetration system used for testing superhard materials, and examples of full penetrations used on the metals series. The numbers at the right indicate materials: (1) copper; (2) brass; (3) mild steels; (4) annealed tool steels; (5) heat-treated machine parts; (6) steel, spring tempered; (7) tools, tough tempered; (8) high-speed steels, hardened; (9) high-carbon steels, quenched; (10) nitrided steel; (11) tungsten carbide, average hardness; (12) tungsten carbide, superhard; (13) white diamond, superhard

Small Shop Economies

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Industrial Engineer
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ELECTRO-PLATING and metal finishing by research and experience have been reduced to an almost mechanical art, though in the early days of manufacture it was entirely skilled work. In the small shop, however, improvements come slowly and some of the worst conditions are found in this particular department. Undoubtedly, the chief fault to be found is that of inadequate cleaning of parts prior to plating. Leave a man to himself and he inevitably becomes dirty both as regards himself and his work. The plating shop exemplifies this statement. The conditions often encountered are these. The washing tanks are of still water and resemble the color of a pool well stirred up. For some unknown reason the top draining pipe has been hammered over at the end, so that when draining is eventually resorted to, this takes away the bottom leaving the scum and dirt at the top. Again, the cyanide tank has been used cold and the man in charge religiously uses it for all types of work quite irrespective of the fact that it is practically useless for any job.

All the work in the plating shop is wired. When a man has finished a few dozen components and is rushed by his foreman for finishing, he is in the habit of carrying them over to the plating shop whence they are strung on wire and plated in the usual manner. There are very few small parts indeed that cannot be plated by the use of suitable baskets. These can be purchased quite cheaply or can be knocked up in the shop from a variety of materials depending on the particular vat they are to be used in. Remarks on this particular department could be continued, in fact there is often very little right with it.

Where fair quantities of small parts have to be polished the rumbler comes in very handy. Quite an efficient rumbler may be knocked up within a few hours. Once in operation, it quickly pays for itself by taking away from the polisher those little screw tops and small brass stampings which really require only the edges removed prior to plating.

The polishing department in the small shop often consists of a small box-like place knocked out of a few planks of wood in which two or three spindles are running. For adequate polishing, an exhaust system of some type or another is absolutely essential. Sometimes, to avoid the expense of this, masks are employed, but in the opinion of the writer they are worse than useless since they rapidly become glutted with powder and at the best of times hamper the sight and breathing of the operator. At the cost of $75.00 or $100.00 a simple exhaust system may be fitted. If, because of structural conditions, an ordinary lead-out pipe involves a long run and many right-angle turns, it is far better to exhaust straight through the roof. This may spoil the appearance of the tiling but it makes for efficiency of operation.

We now come to the inspection of finished parts. We say finished parts for the simple reason that a process inspection is nearly always out of the question. However, a foreman should be held responsible for the quality of the parts turned out from his department. Very quickly he will get to know which of his men are to be trusted to do their own checking and which require his own personal supervision in this matter. For final checking of parts which are passed to the stores, advantage may be taken of the tool stores keeper who otherwise would have a very easy time. By this means it becomes possible to employ a fairly high-rated man with some degree of mechanical knowledge. Further, it prevents gages, etc., being left to the hazards of shop use. Parts from the machines are first sent to the tool stores where they are checked by the tool keeper. Thence, after this signature, they are passed to the material stores and placed in bins.

With a small firm, packing and shipping constitutes another difficulty, since many orders are rush work and have to be shipped at the earliest possible moment. From 4.30 o'clock till closing time the stores department is usually in a state of uproar and frequently material required by the shop is not issued, but left till the next day. As far as possible packing and shipping should be separated from the stores proper though this is not always possible. A high-class man is required for packing the larger articles. Smaller stuff shipped in bulk may be left to sensible lads under his supervision.

On first reviewing the system of controlling any new factory, the newcomer immediately forms opinions of his own as to what ought to be changed. It is best, however, to go very slow at first. Things which appear absurd at first sight often turn out to be the only possible means of achieving a particular end.

The first trouble with the system that the new manager is likely to encounter is that of deliveries. Most small firms who are busy are always suffering from one or two jobs for a valued customer being overlooked and having to be rushed at the last minute. This indicates the necessity for some sort of progress system instead of the casual urges from the offices which usually have to suffice. In the early days of the new management the manager will have to evolve some sort of a system of his own and to keep it up to date. One of the easiest methods of doing this is by the use of a large sheet of squared paper. As each particular job is received from the offices, its number is entered on the sheet and a mark made on the day promised for delivery. It is a comparatively easy matter to keep a check on delivery promised providing foremen are kept to their words; this latter matter is not quite so simple. The one difficulty which arises is that as soon as the number of jobs on hand passes the first hundred, it is almost impossible to keep posted on the different position of each, or even to remember their respective names and particulars. However, the system, though crude, will serve, always providing that cooperation is received from the foremen.

The aim of the manager in any factory is to reduce

cost and increase production. Admirable, but not very easy. Still, considering the small factory, it is essential in the first place to separate the two classes of work into standard and special. Before attempting to arrive at any output figures it is necessary to know the usual consumption. From the office, maximum and minimum stocks of standard lines should be sought. This in itself is useful, but not sufficient. It is further necessary to know the probable sales, or in other words the probable output which has to be maintained during the year. Very roughly this may be arrived at by consideration of the previous order figure. These, added up and plotted in a series of simple curves, serve to show the activity on standard lines. The stores department should be held definitely responsible for reminding when any stock falls near the minimum. Set figures in this respect can be issued.

Issuing Job Orders

Special work of all classes is rather more difficult to handle. Usually the office carries out the preliminary negotiations with the possible customer and when the order is received passes an order form through to the drafting room where the necessary drawings are made. In small factories all orders should pass through the hands of the manager, who may raise any queries before letting the job take its normal course through the shop.

The issuing of job orders to the shop in a small factory is a question which can hardly be fully discussed, since it depends almost entirely upon the type of manufacture concerned. In many instances it is economically out of the question to have extra orders typed out from those received from the main office. A good plan is to have a blank space left on the normal requisition in which further particulars may be added. The order, complete with blueprints, is then issued to the foreman, a duplicate usually being sent to stores so that they may be aware of the date when shipment is expected.

When only one order is issued to the shops, trouble is likely to arise where more than one department is concerned. We refer to instances where the pressure of delivery necessitates more than one department working on a particular job at the same time. This is especially difficult when complete blueprints are supplied by the customer and the value of the job does not permit of re-drawing. Where the brown type prints are sent out, these may often be blueprinted quite satisfactorily, and serve to clear up the question of duplication.

Normally, job cards should be issued once only during the day, the first thing in the morning, and with them should go a job list to each foreman so that he knows on which he is expected to work. Knowing this, he should refer immediately to the actual order and cooperate with other foremen.

The progressing of work from one machine to another and one department to another is difficult in a small factory. Left to himself a workman, when he has finished a job, almost invariably leaves it on the end of the machine or bench, feeling quite satisfied that he has finished his part of the business. This is not a satisfactory state of affairs and has to be modified by some action or other. It is imperative that each job, no matter how small, carry with it its route card, and an operator should understand that quite apart from finishing the job in the minimum time it is part of his duty to see that it is passed along to the next step of manufacture. Where parts are small and can be handled easily, an intelligent boy can be of help in this matter, although he must be given to understand that he is not merely running errands for the men in the shop.

The most delicate question of a small shop is that of wage payment. Usually, either everyone in the factory is paid on a day's work basis or some of the larger jobs are paid for on piece work and the remainder on day's work. Such a condition is bound to lead to dissatisfaction because the unskilled men have been known to go home with a better pay envelope than more skilled men who by the nature of their work are placed on a day's work basis. Even when piece work is used to a considerable extent the piece work cards are apt to be kept in a very slack manner. No piece work card should be considered valid without the foreman's signature made at the time the job was finished, not an hour or so afterwards on the word of the operator.

The institution of job cards of some form or another is probably the best action to take. The form of clock cards that answer for a whole week are useless for job work and were never intended for the purpose. Job cards should bear: the operator's name and clock number; the part number and name; the operation; the date; and the time the job was started and finished.

Further, it should contain the foreman's and the inspector's signatures.

The objection to such a course is that it involves so much paper work. Granted that it is much more elaborate than is usually the case with small concerns, at the same time it is necessary. No employer can be expected to pay men when he has no definite record of what they do and in what time. The card should also contain columns for day's work and bonuses which would be filled out in the office from a consideration of the time taken on the work.

In larger factories where considerable runs are the rule, one card for each particular job is the usual system. In the small factory, however, this is quite useless. In the course of a few days the whole shop will be littered with hundreds of these cards. Quite commonly a man handles half-a-dozen jobs in a day. A compromise must therefore be struck by designing a job card which will include a full day's work. On completion of a job a horizontal line should be drawn beneath it, thus cutting it off from the other items. At the end of each day all the cards should be handed in and passed to the main office for payment at the end of the week.

Piece Work or Wages?

Coming now to the actual question of payment, we find that, in shops handling both special and standard work, the ordinary piece-work system produces dissatisfaction. If piece work is to be adopted at all it must be adopted universally, with the possible exception of the tool makers. Many employers object to the use of piece work at all, and their chief argument seems to be the cost of administration. This is more or less true, since straight piece work certainly involves the cost of a rate fixer, which may be borne when jobs are standard and have long runs, but it is out of the question for special work.

But the great thing to be attempted is to separate standard from special work where possible, even going so far as to put it into different shops. When this is done, the problem becomes much simpler.

The last of two articles. The first appeared last week.

C. R. RANNEY
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Grinding Fixtures for a Threading Die

A precision tool requires precision methods in its manufacture

THE tangent chaser type of thread cutting die, recently brought out by Jones & Lamson Machine Company, is a precision as well as a production tool. A great amount of labor and expense has gone into tools, fixtures and gages to attain the greatest possible accuracy in its manufacture. Before this die was placed on the market, a thorough study of each piece was made to determine the methods to be used and the tools necessary for its production. In the design of each fixture, speed, convenience, and cost were considered, but these never took precedence over accuracy.

The toolroom records show that over two hundred and eighty separate and entirely special pieces of equipment are used to produce the fifteen different parts of this die. This equipment varies from simple templet gages to elaborate indexing milling and grinding fixtures. Every major part of the die is hardened, and all bearing surfaces are ground. The essential operations for final accuracy are necessarily those of grinding. For this reason, the tools and fixtures for the grinding operations require the greatest acccuary and are of most interest. Some consideration of the construction and performance of the die itself is necessary to indicate those essential bearing surfaces which must be held in accurate relation to each other. The line drawing of the assembled die with parts in section, Fig. 1, shows how each part performs. Fig. 2 illustrates the separate completed parts in a group ready to assemble, showing the irregular contour of the various members. Like parts bear similar letters in each of these figures.

The four chasers *J*, Figs. 1 and 2, stand in a position tangent to the work and 90 deg. apart. These

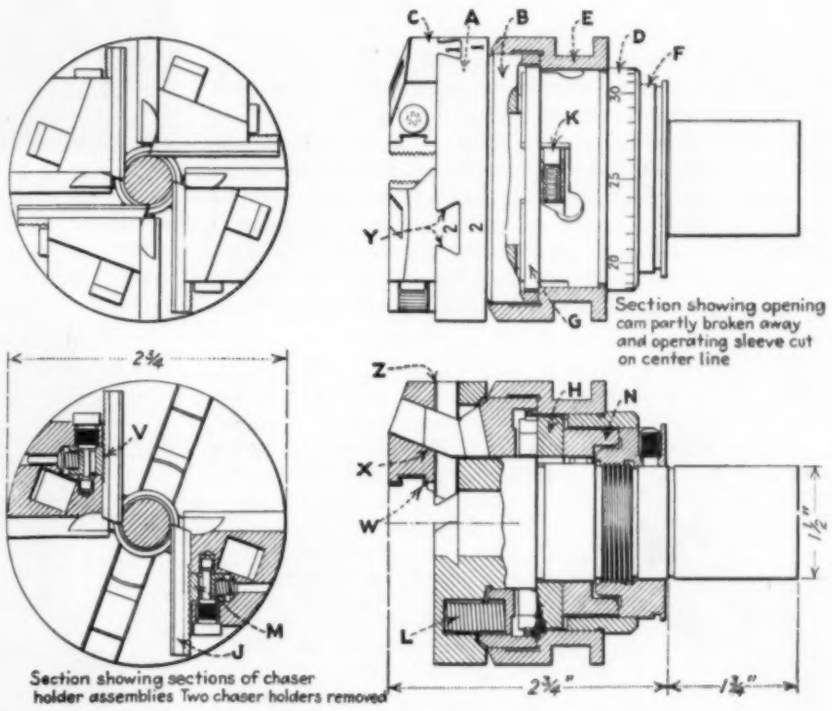


Fig. 1—Although simple in operation, this die must be made so each surface bears the correct relation to its mating surfaces

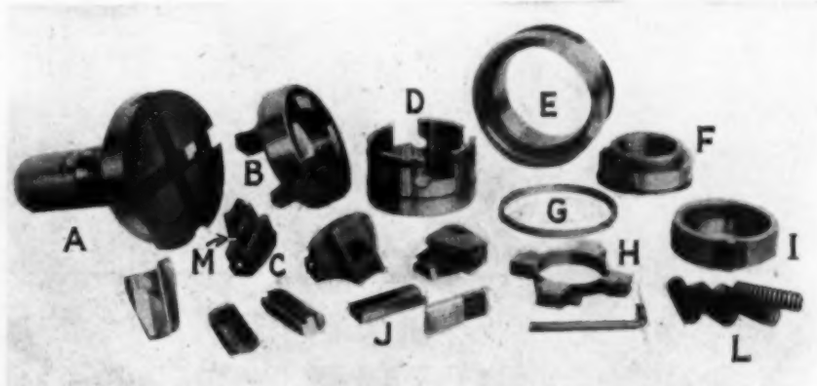


Fig. 2—Parts for this opening die are hardened and ground all over to insure accuracy

chasers are the cutting tools. The prime function of every other part of the die is to hold and control the position of the chasers. The chasers must be accurately located a uniform distance from the center line of the work for diameter control. They must be accurately located from the face of the body so that each will follow exactly in the trace of the others for correct thread form and lead. The faces of the cutting edges must be accurately located for height, for free and smooth cutting. The chasers must be firmly secured to hold their accuracy under stress of the cut.

With the above facts in mind, the essential points on each piece will become evident as the construction is followed by reference to Fig. 1. The dovetail tongues on the chasers *J* fit slots in the chaser holders *C*. They are retained in the slots by spring pins having ratchet teeth on the end meshing with teeth on the faces of the chaser tongues. The holders in turn have dovetail tongues fitting slots in the body *A*. The position and movement of these holders is controlled by four prongs extending from the face of the cam ring *B*. These cam prongs extend through holes in the body and into holes in the chaser holders. The angle of these prongs with the center line of the die is such that lateral movement of the cam along the shank of the body moves the chaser holders to and from the center. This movement opens and closes as well as adjusts the die. Important elements entering into diameter control of the chaser then are the surfaces *X*, *Y*, and *Z*, Fig. 1. Each one of these surfaces

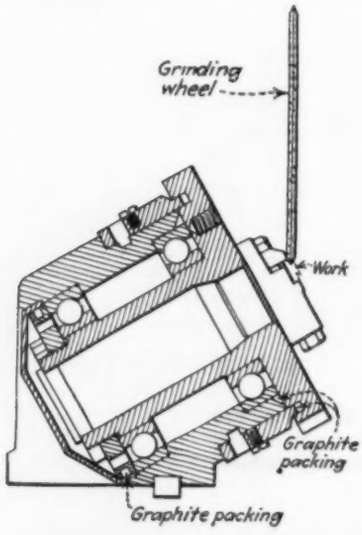
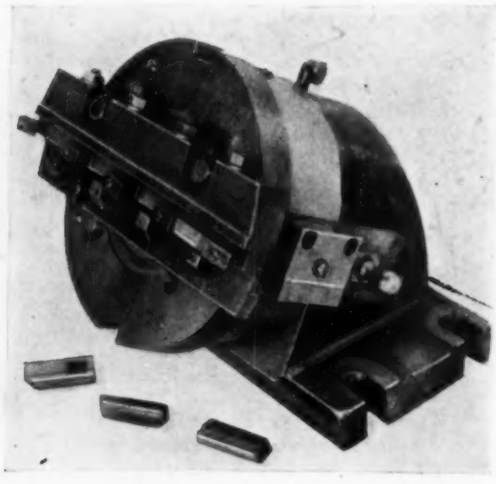


Fig. 3—Left. Every precaution is taken to preserve accuracy by sealing fixture bearings against grit and cutting oil

Fig. 6—Right. Chaser ends are squared and their cutting edges beveled on small special grinding machines

Fig. 4—Below. The chaser dovetail is vital, both for diameter control and precise tracking



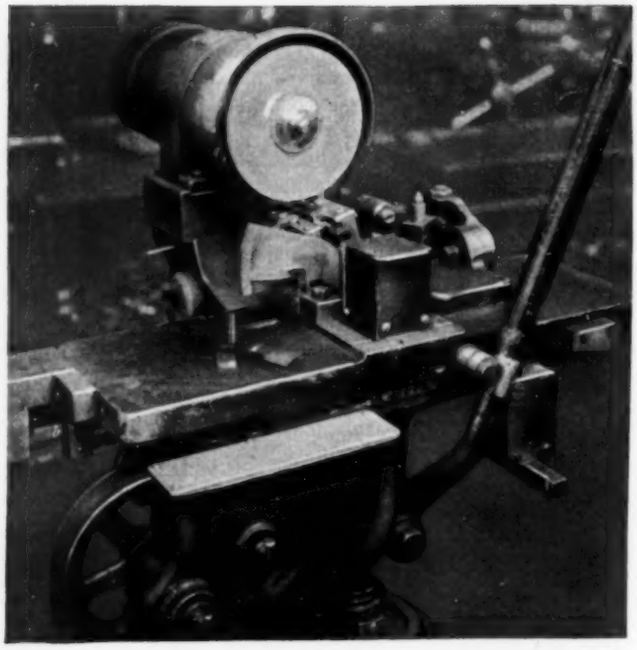


Fig. 5—The chamfer is ground on a swiveling block. Note the convenient wheel truing device

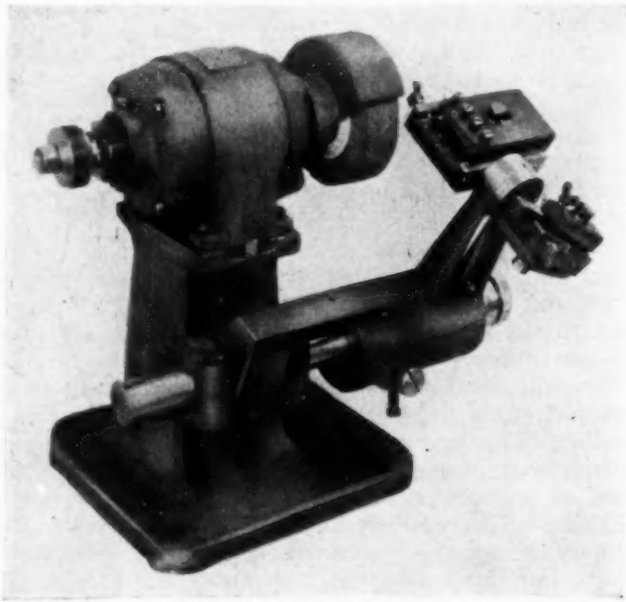
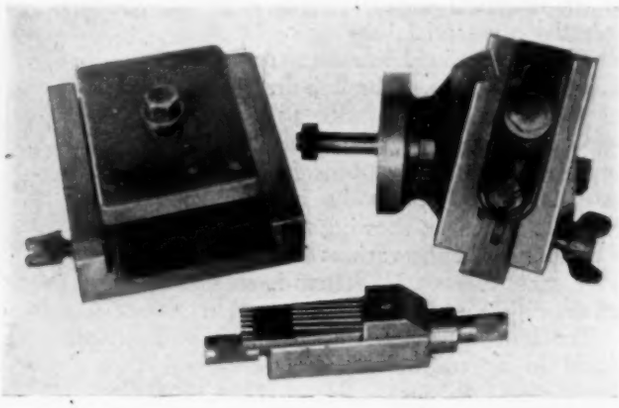


Fig. 7—These blocks hold the chasers for grinding on the machine shown in Fig. 6. Below is a micrometer gage for checking the cutting edge in relation to the ratchet teeth



must bear a fixed accurate relation to each of the others Surfaces *W* and *Z* are vital to the location of the chaser from the face of the body. The ratchet teeth on the pin and chaser indicated by *V* and the surfaces *Y* enter into the location of the height of the cutting edges. The quality of the fits at all these bearing surfaces affects the firmness with which the chaser is held in position. All the play at each joint is evident at the cutting edge.

The locking mechanism, controlling the automatic operation of the opening and closing movement of the cam, is less directly connected to the chaser. However, the control of the chaser position still remains the prime purpose of these parts. On the back face of cam *B* are four lugs equally spaced. These lugs are of the proper width to slide into spaces between arms on the locking ring *H*. In the locked position, the ends of these lugs bear against the face of the arms of the locking ring with the springs *L* compressed. Reference to *H* in Fig. 2 clearly shows small helical surfaces on each of the arms. These helical surfaces bear against helical surfaces in the slots of the inner tripping sleeve *D*. Lateral movement of the inner sleeve actuated by the outer sleeve *E* turns the locking ring against the pressure of a spring pin in one of its arms shown at *K*, Fig. 1. This turning of the ring is sufficient to bring its arms opposite the space between the lugs of the cam. In this position, the springs *L* force the cam back opening the die. The die is closed again by a forward movement of the sleeves in turn moving the cam and compressing the springs *L* until the end of the lugs on the cam reach the face on the locking ring. In this position, the spring *K* turns the locking ring back to the locked position.

The tripping sleeve is keyed to the shank through the driving *N* and retained in the outer sleeve by the retaining ring *G*. The lateral movement of the tripping sleeve and the position of the cam in locked position are controlled by the adjusting nut *F*.

Having traced the operation of the die, the method of producing the parts and the reason for extreme accuracy at various points can be readily followed. Considering the chaser itself, the dovetail tongue must be closely sized and made to bear the correct relation to the thread form grooves. After being roughed out to form in sets of four and hardened, the first grinding operation is that of finishing the tongue. This is done by use of an indexing fixture shown in Figs. 3 and 4. The holding block, capable of holding one set of four chasers, is mounted on an index plate. The angle at which this index plate stands relative to the wheel is such that a 60 deg. included angle V-faced wheel will grind the back face and side of the tongue as a form grinding operation. This method allows the use of a wheel trued by the same truing device that is used for grinding National Standard Threads. Having ground one side of the tongue, the index plate is turned through 180 deg. to bring the opposite side of the tongue into position for grinding.

This method of grinding on an index plate insures symmetrical work as long as the fixture is made so the center line of the work intersects the axis of the index plate. The cross section of the fixture, Fig. 3, shows the mounting of the index plate on ball bearings and also the method used to protect the bearings from grit and the cooling solution by graphite packing rings.

After the tongue is finished to size, all subsequent operations are located from it. The thread grooves are ground in a special fixture on a thread grinder. This grinding is done on one set of four chasers at each setting. Locating from the tongue, the chasers are set to pass across the wheel at an angle to give the proper helix to the thread form. Following the grinding of the thread form, the chamfer is ground.

A feature of the chasers not previously noted is the 3-deg. clearance angle given to the cutting edge by grinding a series of serrations across the chamfer. These serrations ars so located and spaced that if 0.040 in. is ground off the end at each sharpening the chasers can be replaced in the holder one notch ahead of their previous position and still cut the same size. To do this requires a method of holding which will bear a definite relation to the ratchet teeth on the tongue. A grinding machine having an automatic feeding device is used for this operation.

Fig. 5 shows the wheel with a chaser in position ready to start the grinding operation. The chaser is mounted in a block having a dovetail slot which is a duplicate of the slot in the chaser holder of the die. This block is mounted in such a way that it can be swiveled to an angle to correspond to the angle of chamfer. In the block under the chaser slot and in a position correspond-

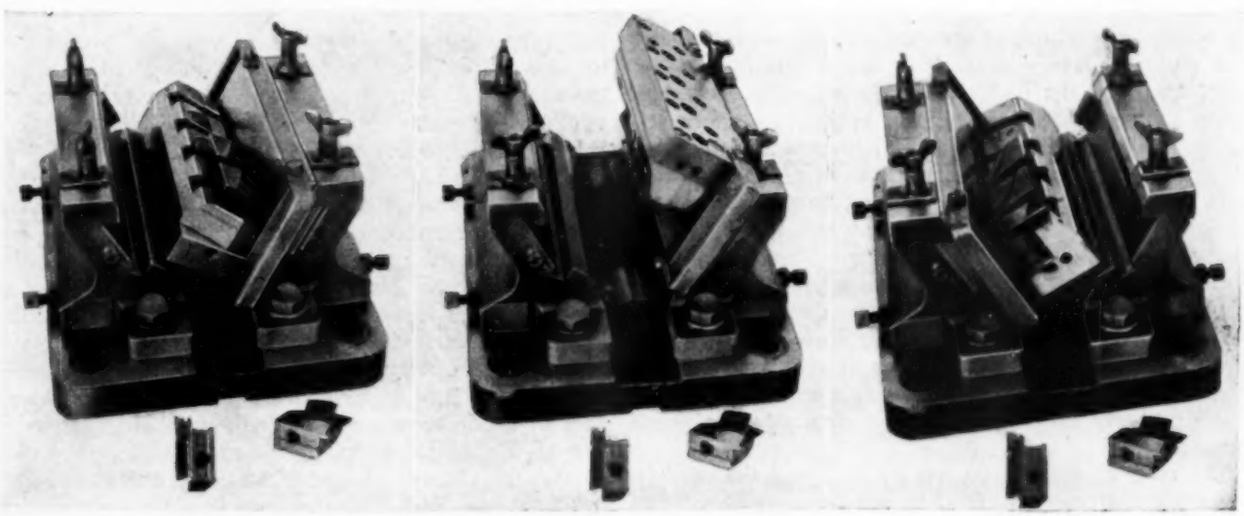


Fig. 8—Three operations are performed in this fixture by varying the position of the workholder. Fig. 9—The workholder is inverted for the second operation. Four chaser holders are ground in each setting. Fig. 10—The parts are held by the dovetails for all three settings

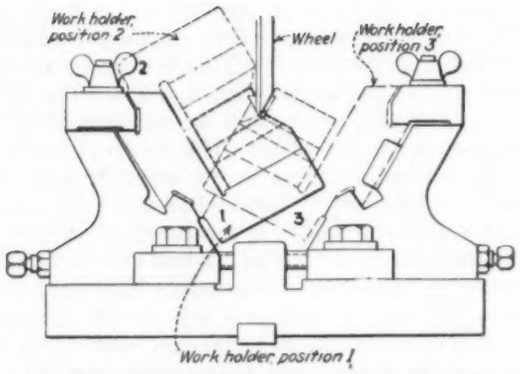


Fig. 11—This fixture, shown in operating positions in Figs. 8, 9, and 10, is designed to utilize both flat and beveled sides of the wheel

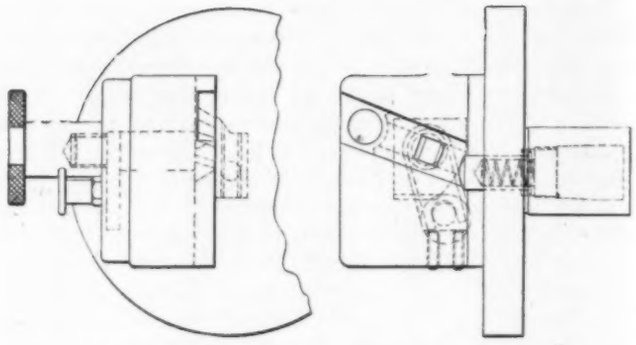
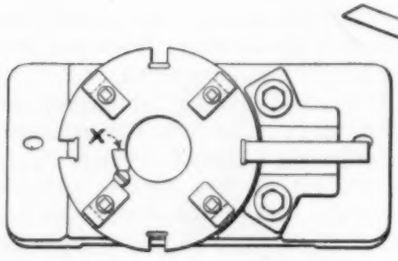
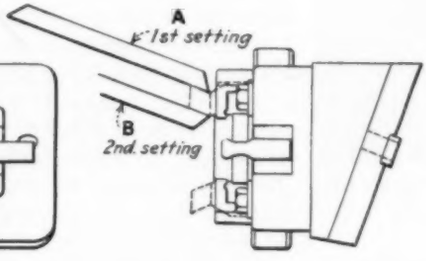


Fig. 12—The thrust pin hole is ground in the chaser holder when held in the chuck shown above





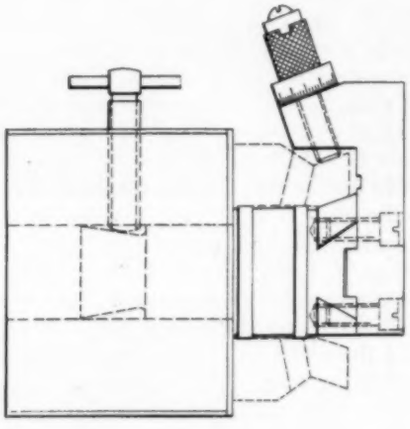


Fig. 15—Right. A micrometer gage checks the accuracy of the outside of the cam prongs

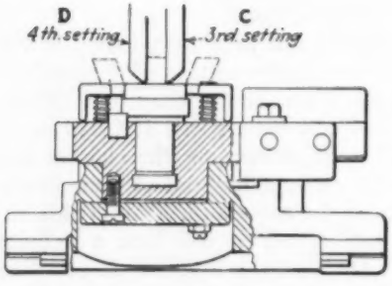
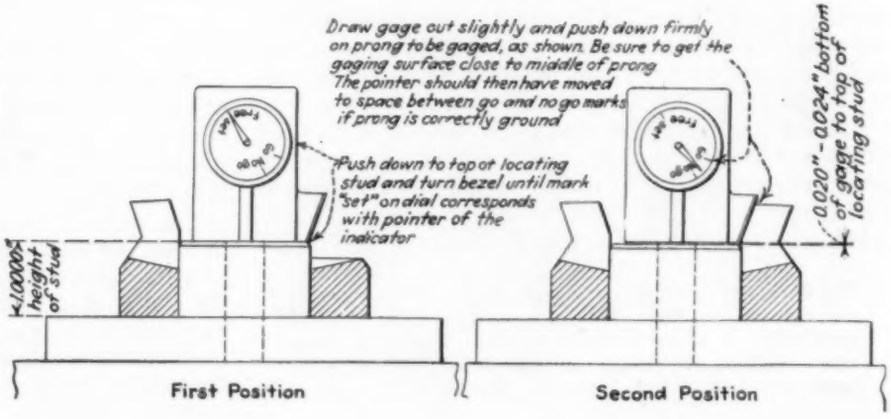


Fig. 13—Above. Since the cam prongs control the chaser positions their grinding is an important operation

Fig. 14—Right. The cam prong main faces are inspected in a special indicator gage


Draw gage out slightly and push down firmly on prong to be gaged, as shown. Be sure to get the gaging surface close to middle of prong. The pointer should then have moved to space between go and no go marks if prong is correctly ground
Push down to top of locating stud and turn bezel until mark "set" on dial corresponds with pointer of the indicator
.020" - .024" bottom of gage to top of locating stud
1.0000" height of stud
First Position
Second Position

ing to the position of the thrust pin in the chaser holder is a plunger, having a single tooth, which fits into a tooth space on the back of the chaser. As the table moves back and forth, the plunger is given a reciprocating motion sufficient to advance the work one tooth at each pass of the wheel. The forward feeding of the work and the travel of the table are automatic and are driven by a motor, independent of the wheel motor, mounted on the base of the machine. Mounted on the work table and capable of accurate adjustment relative to the work holding block is a truing device which can be brought into operation at any time during the grinding process by use of the hand lever at the front of the table. This device will true the face and side of the wheel properly to grind the 3-deg. clearance angles of the serrations.

The ends of the chasers are squared and the cutting edges ground on small grinding machines designed for the purpose. Fig. 6 shows one of these machines set up to square the chaser ends. Fig. 7 shows the holding blocks in detail with a micrometer gage used to check the relation of the cutting edge to the ratchet teeth.

The chaser holder *C*, Figs. 1 and 2, as before explained, is actuated in its movement by the cam prong acting in the square hole. To insure the proper location of all surfaces relative to this hole, all grinding operations are located from it. The first grinding operation after hardening is that of finishing the dovetail tongue. The fixture, in which the work is held for this operation is similar to that used for grinding the chaser tongue. Here again a 60-deg. V-wheel is used for form grinding. The piece is held on a square plug extending from the face of the index plate and is so located that the center line of the tongue intersects the axis of the index plate as for the chaser. Turning the plate 180 deg. brings opposite sides of the tongue into position for grinding.

The dovetail slot, which receives the chaser, is ground in an unusual fixture shown in Figs. 8, 9, 10, and 11. This fixture consists of a base in which a removable workholder rests. This workholder is designed to hold four pieces at a time. Three operations are performed on these four pieces while clamped in the holder. When the workholder is placed in the position shown in Fig. 8, corresponding to Position 1 in Fig. 11, one side of the slot is ground. The workholder is inverted as in Fig. 9, coresponding to Position 2, Fig. 11, and the opposite side of the slot is ground. The workholder is again changed to the opposite side of the base as shown in Fig. 10, or Position 3, Fig. 11. In this position, the flat face of the chaser bearing is ground by the bevel face of the wheel. The fixture is so designed, as shown in Fig. 11, that the center of the V of the wheel is in the correct position for all three operations.

This fixture, to function properly, must be carefully made. It provides a rapid and convenient method of performing these necessarily accurate operations. Since the location of the chaser is dependent upon the thrust pin, care in producing the chaser is of no avail unless this thrust pin hole is accurataely positioned. A special chuck, Fig. 12, is used on a hole grinder to finish this hole. In this chuck, the locating points are the previously finished dovetail tongue and the square hole.

The production of the body and shank calls for careful grinding of the shank diameters and the face of the body. Any variation of the face from a true flat, perpendicular to the shank affects the chaser location. To insure the concentricity of all parts, the shank and thread for the adjusting nut are ground with the work held between centers. The grinding of the thread is done from the solid on a thread grinder.

The final operation on the body is grinding the dovetail slots to receive the chaser holder. For this operation, the same fixture is used that has been previously described in connection with grinding the chaser dovetail. When this fixture is used for the body, the workholder is removed, and the shank of the body inserted in the center hole of the index plate. For this operation, the plate is indexed 90 deg. at a time. When a complete turn of the plate is made, both sides of the four slots are finished. A 60-deg. V-wheel is again used in this case.

Fig. 16—Proper mating of the helical surfaces of the tripping sleeve and locking ring is insured by grinding these parts in the same fixture

The opening cam must slide freely on the shank at the same time fit close enough to be free from any play. The hole must therefore be ground within close limits. The prongs which move the chaser holder must be close to size, at the correct angle, and concentric with the hole. The grinding of these prongs is accomplished in four operations, all of which are performed in one fixture, Fig. 13. The outside cam surface is ground first with a wheel in position *A*. Turning the indexing plates 90 deg. brings the four prongs successively into position. Position *B* shows the relative position of wheel and work for grinding the inside cam surface. Indexing as in the previous case finishes these faces of the cam prongs. The sides of the prongs are finished in this same fixture set at 90 deg. with the wheel arbor as shown in positions *C* and *D*. The location of the work in this fixture is on a center plug, which it fits closely and against the face of one of the lugs noted by *X*. This method of locating assures the proper relation between the cam prongs and locking lugs on the reverse side of the cam.

Fig. 14 shows a gage used for checking the inside face of the cam prongs when the work is mounted in the grinding fixture. This figure explains itself. The dial indicator reads to the line marked "set" when the gage is pressed against the face of the center plug with the bevel edge between the prongs. The gage is then turned until the bevel edge is opposite the center of one of the cam prongs and pressed down as far as possible. The gage should then read between the two lines or in the zone which represents the tolerance for this measurement. Fig. 15 is another gage which tests the outside face of the prongs. The reading of this gage is taken by use of a graduated micrometer screw. This reading is held within a narrow tolerance zone.

Grinding operations on the tripping sleeve and locking ring are simple and can be done by usual methods except the finishing of the helical surfaces. The mating of these surfaces one with the other is assured by grinding both pieces on the same fixture. This fixture is shown in Fig. 16 with a locking ring in position while a sleeve is shown ready to be mounted. Moving the lever back and forth gives a helical advance to the work. This movement is guided and controlled by rolls sliding in slots in a ring mounted at the rear of the spindle. One of these rolls may be seen in the illustration. To bring another surface into grinding position, the locking pin projecting from the top is withdrawn and the spindle turned through 90 deg. The locking pin will then drop into place and the grinding can be continued as before. A diamond for truing the wheel is shown attached to this grinding fixture. This diamond can be brought into operation by a slight change in the table position.

The small chaser thrust pin in the chaser holder is only $\frac{3}{8}$ in. diameter and $\frac{1}{2}\frac{3}{2}$ in. long. The ratchet teeth on the end of this pin, however, must be correctly located relative to the outside diameter. To check the location of these teeth in this relation after grinding the outside diameter, they are mounted in a special fixture in the Hartness Comparator using a properly made chart.

It will be evident that careful and accurate workmanship on these gages is of no avail without constant vigilance in their upkeep. A systematic method of inspection and checking at frequent intervals has been worked out and is carefully followed. All these grinding fixtures were designed with care to prevent dust and cooling compound from reaching the bearing surfaces thus preserving their original precision.

Safeguards for Safety

ROBERT A. SHAW
Safety Engineer

Education in safety methods is not enough to eliminate accidents. Mechanical protective devices should precede the safety program

WHILE attending a safety conference some time ago, I was sitting next to a man who had just been selected to head a safety program in the plants of his corporation. He told me that he was up against an ever increasing accident rate. Obviously enough, he was a man possessed of abundant mechanical ability, but he was short on the technique of safety work.

As we listened to a certain discourse on safety statistics, he seemed to be impressed by a statement that 80 per cent of all accidents can be prevented by education. The speaker went on to describe educational methods in detail, and tried to show what can be done through pamphlets containing safety rules for operators of all kinds of production machinery, cranes, elevators and other equipment. He recommended the use of bulletins and of safety articles in plant publications. He stressed disciplinary measures.

Unfortunately, however, this speaker did not dwell on methods of plant inspection, nor did he suggest that the executive personnel must do its duty by providing mechanical safeguards on machinery and equipment. He overlooked such other important details as the method of reporting accidents and the type of accident report used. Not a word was said about compiling answers to the vital question, "Who or what was responsible for this accident?"

As a consequence this new safety director left the conference happy in the thought that he could prevent 80 per cent of all his accidents through educational methods—all at a fraction of the cost of a program embodying the mechanical safeguarding of equipment and daily plant inspections.

When he arrived back at his plant, he launched several safety committees and held an enthusiastic hurrah-boys rally with the vice-president and manager of production both present. These executives asked all to cooperate with the new safety director and made it generally understood that they were behind his policies.

Bulletin boards were installed at all advantageous locations, and safety bulletins changed periodically. Note, however, that the responsibility for accidents was left entirely with each foreman.

For a few months following, the accident rate decreased notably, and the new safety director was jubilant. But during the fourth month, a serious accident occurred; a die being carried over the heads of workmen, fell from the crane, permanently injuring one man. Upon investigation, it was found that no inspection or test of chains and ropes had been made. The wire ropes had worn because the crane was not equipped with a limit switch, and the dies had never been grooved to prevent them from wearing down the lifting chains.

Within a week or so a shaper knife in the pattern shop broke, and an operator received two broken ribs. This was found to have been caused by a faulty slot in the knife. But guards were completely lacking, and the speed of the shaper spindle had never been tested.

Not long afterward a heavy manufactured part dropped from the hook of an overhead conveyor, injuring an employee on the head. It was noted that there was no screen guard under this conveyor and that the hooks holding the parts were entirely too small. Almost the same day, two serious accidents occurred in the press room resulting in the loss of one hand in one case and four fingers in the other. These presses had no mechanical safety devices attached, nor were tweezers provided for use of the operators. It was found, however, that the operators had plenty of safety pamphlets.

The climax to this series of accidents came quickly, for about this same time the plant was getting ready for a night shift. A new man was being taught to operate an electric crane. One afternoon, after he became reasonably proficient in its operation, the regular operator climbed up above to grease the gears while the crane was in motion. His sleeve caught in the driving gears. His arm was rolled into the gears to the elbow.

After this excruciatingly painful accident, employee morale dropped almost to zero. Something had to be done to save the safety program, and done quickly.

Almost overnight, the corporation heads authorized thorough periodical plant inspection, and announced an appropriation to safeguard every item of equipment.

But this writer insists and contends that the corporation lost fully a year in its safety program and almost wrecked it because it did not safeguard its machinery and equipment as the very first step.

It should be axiomatic that effective mechanical safeguarding is the first and most essential step in any safety program.

■

Use of a fillet putty to cover welded joints should be deferred until after inspection; otherwise operators may apply it to cover faulty work. Ordinary "Smooth-On" makes a good fillet putty. Stress relieving in a furnace often causes scale which is removed with difficulty. Scale may be avoided by painting the piece, or at least finished surfaces, with a mixture of yellow ochre of the consistency of thick cream. The ochre becomes a powder after heating, and may be brushed off.

Ideas from PRACTICAL MEN

A Cutting-Off Tool

HARRY SHAW
Consulting Engineer, Heywood, England

Of all lathe tools, the cutting-off tool probably gives the greatest amount of trouble. Because of its thin section and unsupported heel, it breaks very easily. This weakness and lack of support makes it necessary to use much slower feeds than would be possible with a stronger tool. A cutting-off tool is not ordinarily easily or advantageously made as a small inserted piece in a tool holder.

The cutting-off tool shown in Fig. 1 has many advantages over the ordinary form. Chief of these is rigidity which is insured by the great length of the part gripped. The illustration shows how the tool may be used for smaller sized work, as it is ground, so it will have a long life before it is useless. The tool bit is nearer to one side of the holder than the other to enable it to work close to shoulders.

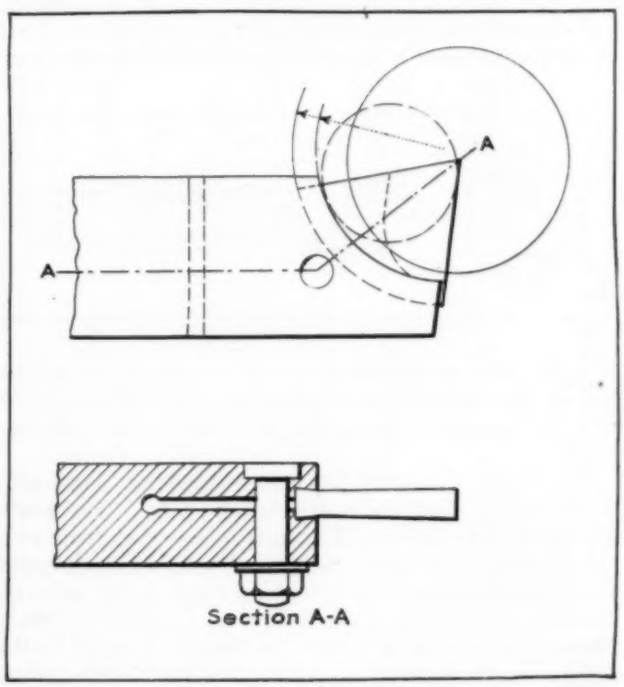


Fig. 1

The manufacture of the holder calls for no comment, but the methods employed in making the inserted cutting bit are rather interesting. It was at first thought that the best way to make the bits would be to turn a disk from a bar or from a forged blank and then cut this into sectors. But finally it was decided that the cheaper and better way would be to make the bit from a flat bar, as less material would be wasted, and the material would more likely be of greater homogeneity than from a large round bar.

A bar of flat tool steel was cut into trapeziform pieces as shown in Fig. *2 A*. These pieces were arranged as shown at *B*, upon the fixture *C*, being held in place by the clamping washer and nut shown. They were then turned on the outer edge to the circular shape shown by the dotted line in Fig. *2 B*, groove *D* being turned simultaneously.

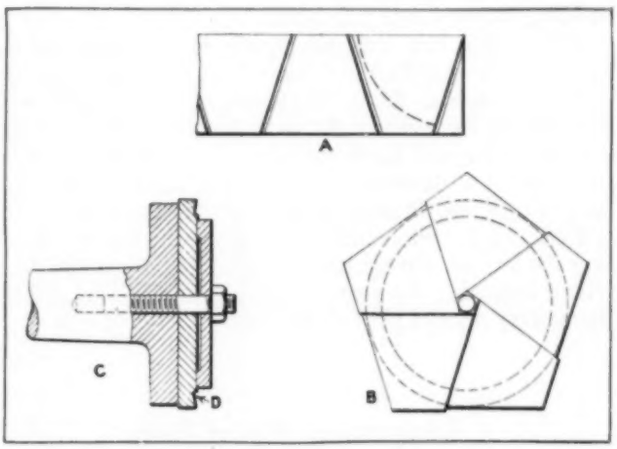


Fig. 2

The next operation consisted in turning the pieces over, clamping them in the same way as for the first turning operation, and turning the groove in the other side. For the next operation—that of turning the side clearance—the pieces were located by a projection that fitted into the turned groove, as shown in Fig. 3, and held to the fixture by the surrounding ring shown. After the metal shown by the dotted line had been turned off,

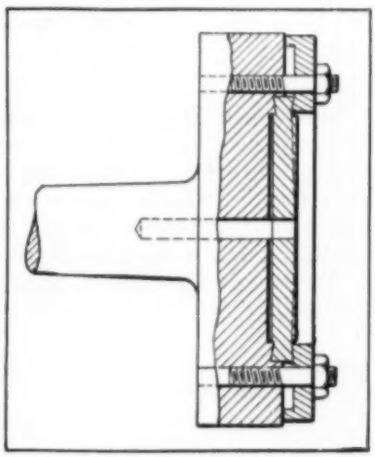


Fig. 3

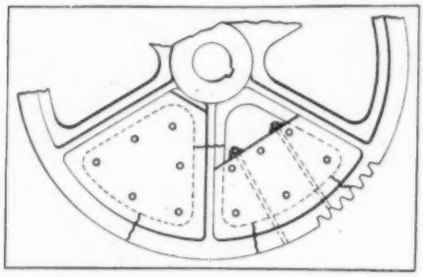
the pieces were turned over and the same operation performed on the other side.

After hardening and grinding, the tools were ready for use. It was found that with exercising care no troubles arose and production costs were very low.

Repairing a Broken Gear

ARCHIE F. BENNIE

A large cast-iron gear was broken as indicated in the sketch. A new gear was ordered, but to hold the machine idle until its arrival was out of the question, so we made temporary repairs in the following manner: Where the rim was simply cracked between two spokes, two pieces of ½-in. boiler plate were fitted between the rim and the spokes, one on each side of the gear. The plates were clamped to the webs of the spokes and the rim with ⅝-in. bolts, holding the rim tightly in place.



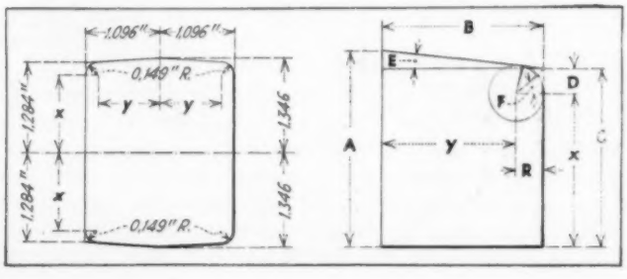
Where the rim was completely broken between the spokes, it was drilled and tapped on the inside for two long ⅝-in. studs. Then two pieces of boiler plate were clamped on the webs of the spokes and the rim, the studs extending beyond the inner edges of the plates. Heavy washers of a diameter to span both plates were placed over the studs, bearing against the inner edges of the plates. Nuts on the studs were drawn up tightly, drawing the broken rim against the outer edges of the plates. After balancing the gear, it was put into service and the temporary repairs proved satisfactory.

Instrument Panel Dies

C. W. HINMAN
Chief Tool Designer,
Kobzy Tool Company

Instrument panels for automobiles usually contain irregular openings for the ammeter, motometer, oil gage, and speedometer. In designing perforating punches and dies for these holes, care must be taken to dimension the drawings properly for the jig-boring operator. To do this, a few computations are necessary.

We had several sizes of openings to compute for two panels of which that illustrated is typical. Like all automobile work at this time of the year, the job was in a great hurry. Every effort was being made to gain time.



We were required to find the dimensions x and y, locating the centers of the four arcs which formed the corners of the openings. The radii of these arcs, designated as R, each measured 0.149 in.

The dimension y was easily obtained from B minus R. For x, we derived a formula which has a universal application to cases where angular lines are tangent to a given circle. Referring to the drawing:

$$x = C - D \tan F = \frac{D}{R}$$

And $$D = R \tan F$$

But $$F = 90° - \left(\frac{E + 90°}{2}\right)$$

Then $$x = C - R \tan \left[90° - \left(\frac{E + 90°}{2}\right)\right]$$

Applying this equation to the example given—

$$\tan E = \frac{A - C}{B} = \frac{1.346 - 1.284}{1.096} = 0.0566$$

Then $$E = 3° 14'$$

$$x = 1.284 - \tan \left[90° - \frac{93° 14'}{2}\right] 0.149$$

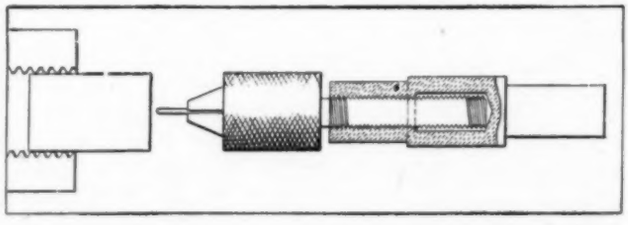
$$= 1.284 - 0.149 \tan 43° 23'$$

$$= 1.284 - 0.1408 = 1.1432.$$

Deep Drilling of Small Holes

J. T. TOWLSON
London, England

Deep drilling may be defined as the drilling of holes to depths which are fully 50 times the diameter of the drill. An example would be a hole drilled to a depth of 1 in. by a drill 0.020 in. in diameter—for instance in dies for covering wire for electrical purposes. In such dies, the holes range from 0.013 to 0.032 in. in diameter, and to drill the holes to the depth required, any kind of mechanical feed is ruled out for want of sensitiveness.



It is not alone the economy of drills that has to be met, but of the work, because generally a drill breaks when it is far in a deep hole, where it sticks and spoils the work.

The device illustrated has been successfully used with the drilling of deep holes of small diameter. The work, a piece of ⅜-in. hexagonal steel, is held in the chuck of a small lathe. The drill chuck is mounted on a threaded arbor that is screwed into a shank held in the tailstock spindle. In operation, the drill is set to project slightly beyond the jaws of the chuck, and is fed forward by the tailstock until it touches a piece of paper held against the face of the work. Letting the tailstock spindle

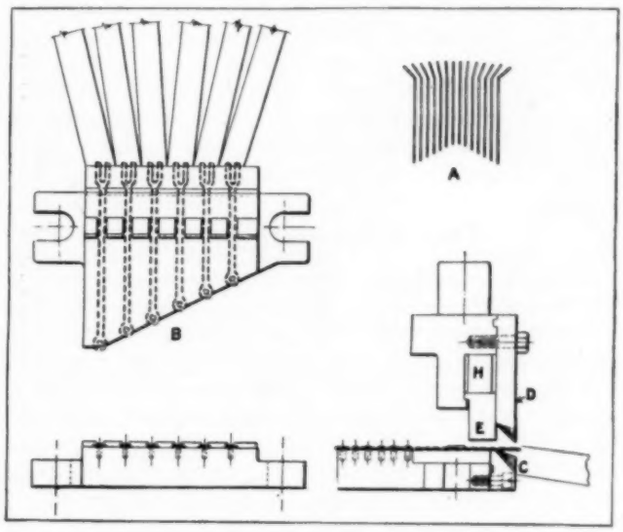
remain in this position, the lathe is started and the drill is fed to the work by means of the fingers and thumb, grasping the chuck by its knurled body and screwing it out. When the drill has penetrated the work as far as its length from the chuck will permit, the chuck is screwed back and the drill is set out farther, and so on until the hole has been drilled through the work.

Besides the infinite sensitiveness of the finger and thumb feed (a quality impossible to overrate on such work), the right-hand thread on the chuck arbor acts as an automatic release when the drill meets the slightest snag. When they do occur, the operator is sure to feel it and lets go of the chuck. The friction of the drill in the work rotates the chuck and the threaded arbor is screwed back into the shank, effectively releasing the drill from its snag. It was a case of a dozen drills before adopting this device to one after, with the same proportion of spoiled work.

Press Tools for Bending Levers

S. A. MCDONALD

In the operation of a certain machine, fourteen levers of various lengths were required, arranged as indicated diagrammatically at *A*. Two of the levers were straight, while the other twelve were bent to various angles at their bifurcated ends. Since the levers were symmetrical, it was necessary only to consider tools for bending



six of them, the direction of the bends being taken care of in assembly. It was at first planned to make six simple bending tools, one for each lever, but as that would have necessitated considerable tool setting it was decided to make one set of tools for bending the six levers at one time.

Referring to the illustration, the lower member of the tools consists of the cast-iron bolster *B* and the bending bar *C*, which is secured to the bolster by screws. A rib on the upper face of the bolster is slotted to receive and space the levers, each one being located and aligned by a pin passing through the eye. The bending bar is machined to suit the angles of the various bends.

The upper member of the tools consists of the punch-holder, the bending punch *D*, the pressure plate *E*, and the rubber pad *H*. The bending punch is machined at angles corresponding to those of the bending bar. The pressure plate is fitted to slide vertically between the bending punch and the punch-holder, and is backed by the rubber pad.

In operation, the levers are placed with their eyes over the pins in the bolster, according to length, and are aligned by the slots in the bolster rib, the ends to be bent projecting beyond the bending bar. On the downward stroke of the press, the pressure plate contacts with the levers and, being backed by the rubber pad, holds them firmly in place. As the ram continues its downward movement, the levers are bent over the bending bar by the punch. The stroke of the press is so adjusted as to give the levers enough squeeze to set the bends permanently.

As the ram ascends, the levers are lifted clear of the pins by hand, and since the press is inclined, they slide over the bending bar into a six-way chute and into a tote box having six compartments, thus keeping them segregated.

Threading on a Horizontal Boring Machine
Discussion

DONALD RAEBURN
Glasgow, Scotland

In the interesting article by John Kopp, under the title given above (*AM*—Vol. 74, page 623), there is one point that invites criticism, and that is the use of chasers having a full thread across their width. When using a chaser on internal work, the tops of the threads should be ground off at an angle, as indicated in the sketch, leaving but two full threads.

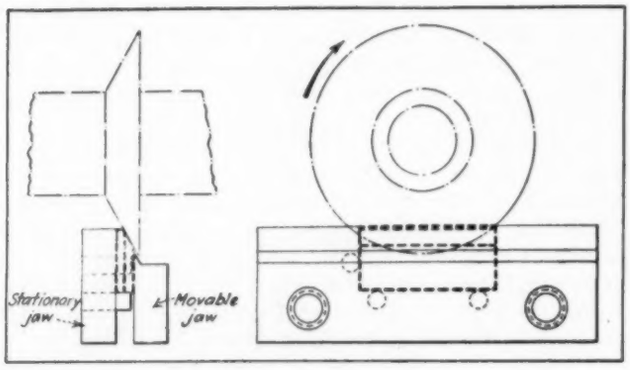
Chasers ground in this way relieve the strain of cutting, prevent chatter and chipping the threads, giving a clean, smooth finish. Also they eliminate the necessity for using two chasers, one for roughing and the other for finishing. Rigidly supported, they reduce the number of passes through the work. Besides, they can be used to advantage in the chucking lathe and the vertical boring mill or wherever thread chasers are required.

Eliminating a Burring Operation

C. COLE

A pair of vise jaws was made for holding short blanks for knife blades while the cutting angles were being milled. The blanks rested upon two pins, a third pin acting as a stop, all the pins being held in the stationary jaw of the vise. Since but one blank was milled at a time, a large burr was formed at the unsupported cutting edge, resulting in the necessity for a burring operation to remove it.

To eliminate the necessity for the burring operation, the pins were made long enough to act as a support



and a stop, respectively, for two blanks. One blank only was milled at a time, the other one acting as a backing, and being slightly nipped by the cutter, as shown in the illustration. Since the blank being milled was backed up by the blank behind it, the burr formed was almost negligible and was removed in the sharpening operation.

In continuing the operation, the blank that was nipped by the cutter was moved from the back to the front, another blank being placed behind it. Thus the operation of burring was eliminated on all the blanks milled. The blank that was used as a backing for the last one milled was held over for the next run.

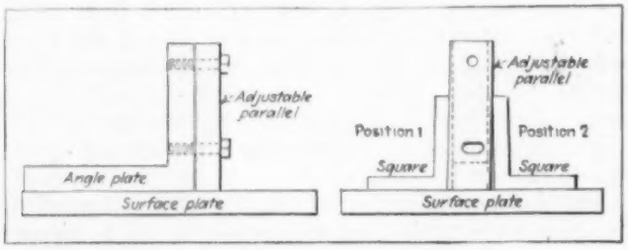
Making and Checking a Flat Square
Discussion

WM. BUTZLAFF

In an article under the title given above (*AM*—Vol. 74, page 765), John J. McHenry describes his method of checking a flat square by an indicator. While Mr. McHenry had everything to make a good permanent fixture for checking squares, it looks as if his toolmakers missed a good bet.

The accompanying sketch shows a fixture that has been used in checking squares for many years. A narrow angle plate is provided with an adjustable parallel that is wider than the face of the angle plate. With the angle plate placed on a surface plate, the square blade is brought against one edge of the parallel, and the parallel is adjusted to shut off all light between it and the square blade. Moving the square so that its blade is against the opposite edge of the parallel, any error in the square will appear doubled.

It is necessary only to reduce the error in the square until the blade shuts off all light when placed on both sides of the parallel. Then the square will be "square." Since light can be seen between two surfaces where an indicator would not register the error, the light test is more accurate than if an indicator were used.



SEEN AND HEARD

JOHN R. GODFREY

Grinding Railroad Bearings

Railroad shop men have long finished bearing surfaces by rolling them. Axles, crankpins and piston rods have all had the roller treatment which began to be popular before the present-day grinding machine came into its own. And some are still deluding themselves that rolling gives a better surface than grinding. Recent tests in the Roanoke shops of the Norfolk & Western show that grinding is much better in every way, not only microscopically but in actual service. These tests included rolling and running both with and against the direction in which they were turned. The newly ground surface was almost identical with that of the same bearing after running 50,000 miles in service. Rolling had its day, but grinding seems to be better.

Drills for Light Alloys

The drilling of dep holes in aluminum or magnesium alloys sometimes plays hob with the twist drill as regularly made. The steep helix of the flute does not seem to get the chips out, and they are likely to clog and break the drills. One large user of these light alloys has hit on the plan of using the kind of drills made for drilling marble. They have a greater helix angle and a thinner web which gives a larger flute. They look a lot like an auger for boring wood, but they have the regulation metal-drill point. And they do the trick with less drill breakage. They are not a special drill but are made by most drill makers.

Worked Himself Out of a Job

Basing of overhead on direct labor puts a kink in reducing the percentage of any set figure. One good engineer we know worked himself out of a good job by reducing labor costs so much that the overhead went up over 150 per cent, which was the dead line in the manager's alleged mind. Just how such managers hold their jobs is a problem for Einstein.

Scraping and Good Machining

If we only knew what the other fellow has in mind when he writes there would be fewer misunderstandings and discussion. Some time ago (*AM*—Vol. 74, page 66) I wrote about eliminating hand work by doing a perfect machine job. But instead of saying "perfect" I used the word "good," which laid the article open to all kinds of justifiable criticism. Machine work may be "good" in the accepted sense and still require scraping to get the right fit. And there are many conditions both of shop equipment and practice where this is the best thing to do. But when, and if, we get perfect machine work, the scraper must hunt another job. And there are shops today where he is very little in evidence. Scraping is by no means an evidence of a poor machine. It may only indicate a preference for accuracy by that method.

SHOP EQUIPMENT NEWS

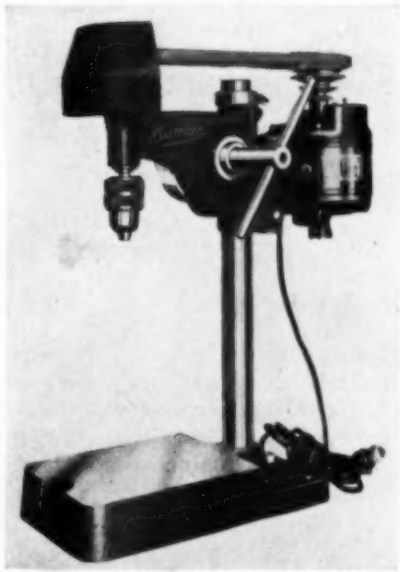
"Tritrol" 30- and 36-In. Heavy-Duty Engine Lathes

Heavy-duty engine lathes in 30- and 36-in. sizes have been developed by the Sidney Machine Tool Co., Sidney, Ohio, for which Joseph T. Ryerson & Son, Inc., Chicago, Ill., is general distributor. Among the features of these lathes are: the direct-reading 16 speed control; the totally inclosed, anti-friction, self-oiling gearbox; anti-friction end gearing, and the anti-friction centrally oiled apron. The carriage is guided on the bed by large V's at the front and at the back by a flat bearing placed under the bridge, where the tool pressure is absorbed. The gibs are located in the center of the bed on square guides, which not only keep the carriage from lifting under the heaviest cuts but also strengthen the bridge. The bed is of four-wall construction, cast from 0.50 to 0.60 carbon alloy steel with a 1 per cent nickel content.

The headstock is of full herringbone-gear design and operates on anti-friction bearings. All bearings are adjustable for take-up from outside the headstock without removing the cover. A force-feed lubrication system supplies lubricant to all bearings.

Both the spindle and all drive shafts are made from alloy steel forgings. The positive jawed clutch, together with the herringbone geared headstock, makes possible sudden spindle speed changes without danger of damage to the work, tool or the machine. The gearbox is lubricated by a central oiling system.

The heavy double-walled apron is equipped with anti-friction bearings. The non-revolving snap lever apron controls can be thrown out or in quickly, but will not slip out of engagement under the heaviest loads. A lever on the aprons provides a reverse to all feeds without reversing the spindle.

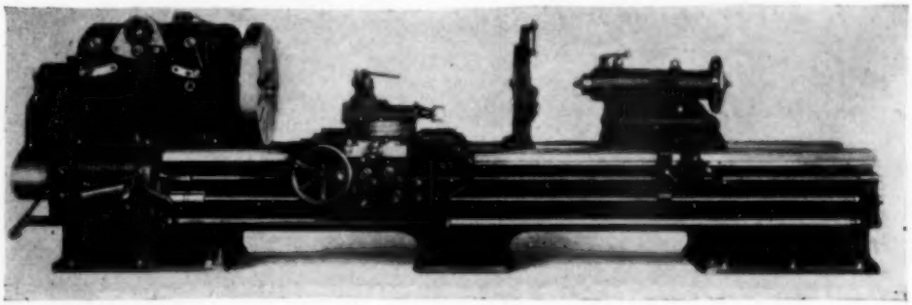


"Simplex" 13½-In. Sensitive Drill

Several operating arrangements of the "Simplex" 13½-in. drill make it suitable for toolroom drilling and supplementary operations. It is announced by the Buffalo Forge Co., Buffalo, N. Y. The entire head of the drill travels up and down on the column, whereas the spindle is stationary and forms part of the head. For drilling low work on the baseplate, the head may be lowered to within 3 or 4 in. of the base. The head may also be swung to one side, permitting the machine to be used like a radial drill on odd-shaped work. The head can be swung entirely around the column and locked in any position. A 4-step V-belt drive is featured. The motor can be tilted for adjusting the belts. The four spindle speeds are 855, 1,210, 2,380 and 3,400 r.p.m. The motor supplied is either ⅙ or ¼ hp., and a switch is built-in.

A grinding attachment can be had which operates directly off the V-belts. It can be easily swung in or out of operating position, and it is not necessary to remove it when drilling. A flexible shaft can be attached to the grinder shaft for drilling, shearing and grinding.

Specifications: Height, 26 in. overall; drills to center of, 13½-in. circle; height of column, 21 in.; diameter of column, 1¾ in.; travel of head, 12 in.; greatest distance between spindle nose and base, 14 in.; working surface, 8x10 in.; bench space, 10x9 in.; net weight, 83 lb.; drilling capacity with ⅙-hp. motor, ⅜ in.; drilling capacity with ¼-hp. motor, ½ in.



"Tritrol" Heavy-Duty Engine Lathe, which is available in 30- and 36-in. sizes

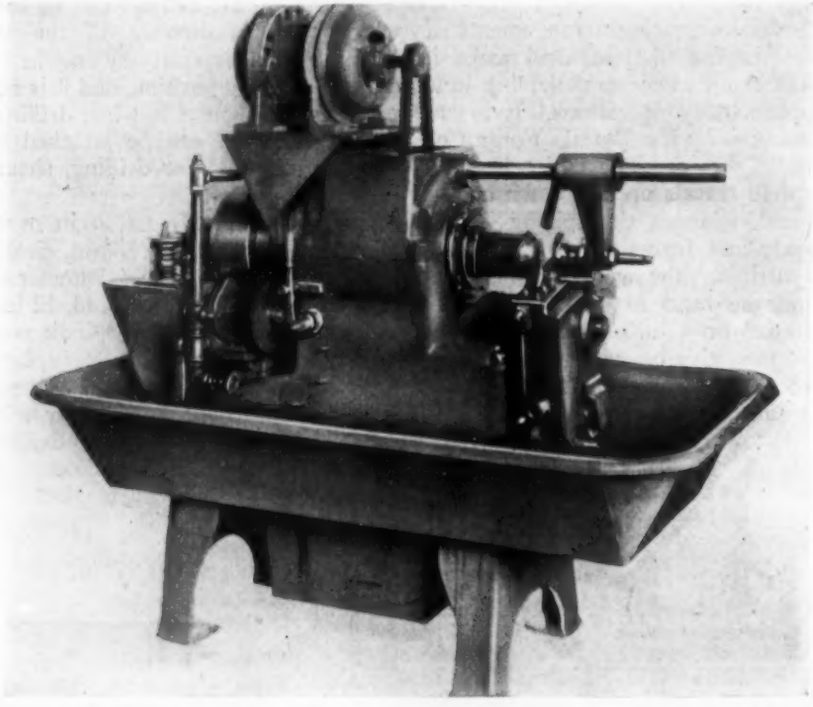
Rickert-Shafer Pipe and Rod Cutting-Off Machine

A cutting-off machine suitable for cutting-off pipe nipples, but easily adapted to cutting off rods and tubing, has been developed by the Rickert-Shafer, Co., Erie, Pa. In the design of this machine, instead of mounting the toolholders on a cross-slide, they are mounted on oscillating arms, which are controlled by adjustable cams. This construction gives any length of cut and feed desired. For cutting pipe nipples, a V-type forming tool makes the preliminary cut, after which the roller cutter on the opposite side completes the operation. This produces the chamfer on the end of the nipple. Using the roller, instead of a parting tool, results in the saving of metal, which is of importance where large quantities of pipe are to be cut up in a day's run.

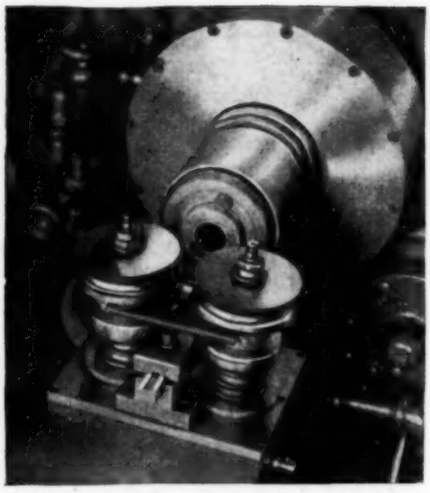
The forming tool, being mounted tangentially in relation to the work, produces a "flow chip." This feature, combined with the cam controlled method of feeding and the rigid mounting of the oscillating arm, eliminates chatter, thereby adding to the life of the tools.

On this machine the work revolves, being fed through the hollow spindle by the feed rolls on the back end. These feed rolls are driven and controlled in such a way that they are in contact with the work but a fraction of a second. As soon as the work strikes the stop and is gripped by the chuck, the rolls are pushed back by means of an automatically-controlled sliding wedge. A three-jawed, push-in collet is employed for gripping the pipe, the draw-in rod being actuated by an air cylinder mounted on the rear of the spindle. The jaws are interchangeable to accommodate various diameters of pipe or tubing.

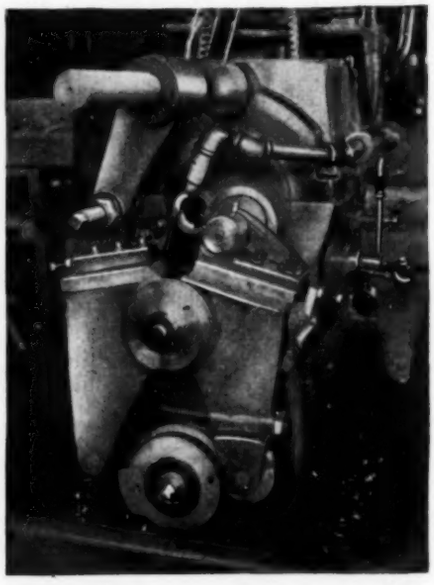
In order to avoid "heating" which frequently occurs where revolving air cylinders are employed, the cutting oil or compound, which is used for the tools, passes through a jacket surrounding the air port housing on the cylinder. The operation of the air cylinder is controlled by cam-operated valves, the cams being adjustable for accurate timing. Coolant is drawn from a large tank by means of a chain-driven coolant pump. The spindle is mounted in ball bearings.



Rickert-Shafer Pipe and Rod Cutting-Off Machine set up for cutting off pipe nipples



Feed rolls which contact with the pipe only until the work strikes the stop and is gripped by the chuck



Toolholders are mounted on oscillating arms, instead of on cross-slides, and are controlled by adjustable cams

"Hardweld" Hard-Facing, High-Carbon Electrode

For building up worn steel wearing surfaces, the Lincoln Electric Co., Coit Road & Kirby Ave., Cleveland, Ohio, has developed the "Hardweld" electrode, which has a special coating and contains about 1 per cent of carbon. This electrode is designed for use in building up cupped or worn rails, locomotive tire flanges, car wheels, oil-well drill bits, tractor shoes, dipper teeth, dies and other wearing surfaces. The weld produced

has a tough dense surface of moderate hardness and will resist wear and abrasion. The special coating eliminates "wildness" of the arc and boiling. When deposited on straight high-carbon steel and allowed to cool naturally, the hardness of the deposit ranges from 290 to 425 Brinell. A harder surface may be obtained if it is peened after being welded and a still higher hardness if quenched in cold water.

Hardweld electrode should be used with reversed polarity and an arc voltage of 20 to 25 volts. The range of current values is wide and can be adjusted for the job in hand. The $\frac{3}{16}$-in. electrode operates best at 150 to 225 amp., and the $\frac{1}{4}$-in. electrode at 225 to 350 amp. The electrode is packed in 25-lb. tin containers and is made in diameters of $\frac{3}{32}$, $\frac{3}{16}$ and $\frac{1}{4}$ in., in lengths of 14 in.

Wright Electric Trolley Hoists

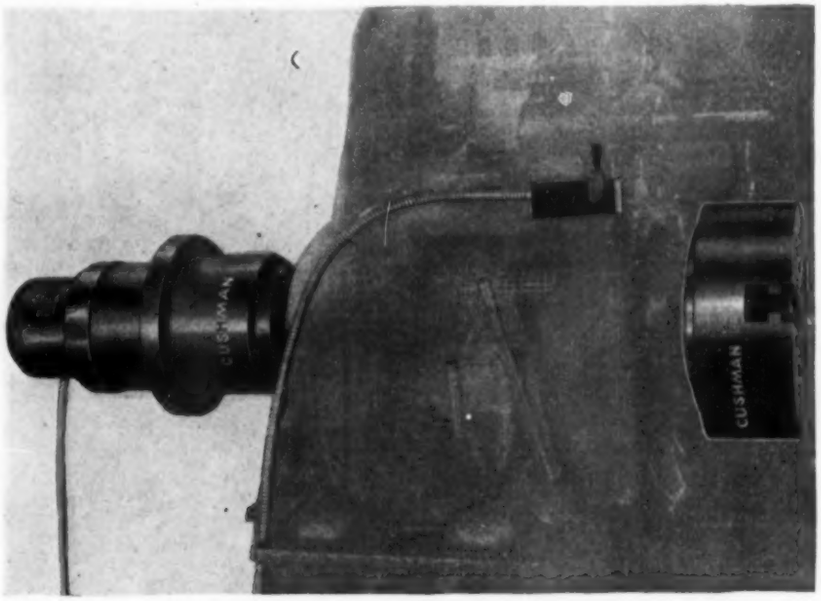
Plain, geared and motor-driven trolley hoists have been placed on the market by the Wright Manufacturing Co., Bridgeport, Conn. The bearings for the trolley wheels of these electric hoists are designed to absorb both radial and thrust loads, thus reducing the effort of moving along an I-beam to a minimum. In the motor-driven trolleys, the wheels are driven on each side of the I-beam to insure smooth operation. These trolleys are equipped with a safety stop. Controllers for single-speed, two-speed, or variable-speed operation can be furnished.

The hoists can be mounted either parallel or at right angles to the runway beam. While the standard lift is 18 ft., lifts of 9 and 36 ft. can be furnished. Other features are the full-size drum, push-button or pendant-rope control, "Tru-Lay" preformed cable, safety-type limit switch, positive braking and weather-proof motors.

"Cushmatic" Electrically-Operated Chuck

Power is used on the "Cushmatic" electrically-operated chuck, announced by The Cushman Chuck Co., Hartford, Conn., only when the chuck jaws are being closed or are being opened. The equipment consists of two distinct units, a lever-operated chuck having two or more jaws and a motor with gear reduction unit. These units are connected by a drawbar of suitable length, and a control box is so arranged as to regulate the pull of the drawbar. In the control box are housed reversing switches, and also when required a rheostat control so as to permit flexibility in the chucking pressure. This control box is attached to the wall or to any other convenient place on or near the machine. It is not shown in the accompanying illustration. The lever switch, which is used for opening and closing the chuck jaws, is placed near the operator's station on the machine.

All sizes of Cushmatic chucks have been designed to give a combined jaw movement of 1 in. One and one-half seconds are needed to make a full jaw movement, and if a shorter movement is required the time is correspondingly reduced. The chuck jaws, jaw levers, jaw lever pins and center plug pins are made of chrome-nickel steel, heat-treated. Other parts are of tool steel. The chucking pressure developed is a maximum of 10 tons, and can be reduced by means of the rheostat control to 50 per cent of this value. Sufficient chucking pressure is thus available to equal the pulling power of the machine and thus afford maximum cutting feed.



Arrangement of "Cushmatic" Electrically Operated Chuck. The chuck proper is connected to the motorized gear-reduction unit by drawbar. Control is by the switch shown and a control box not illustrated

"Purox" No. 11 Welding Torch and Cutting Attachment

Two additions have been made to the line of "Purox" medium-welding pressure apparatus for oxy-acetylene welding and cutting by the Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

The Purox No. 11 welding torch, which supersedes the No. 10, is suitable for welding from the lightest sheet metal up to $\frac{1}{2}$-in. plate. The tips are of one-piece, hard-drawn cop-

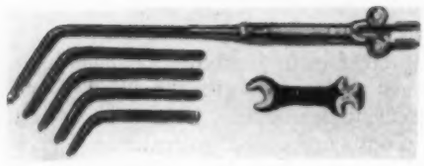


Fig. 1—Purox No. 11 welding torch as supplied with five tips and a wrench

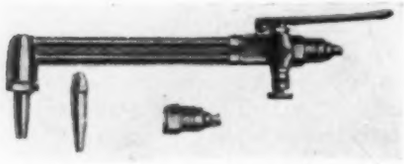


Fig. 2—Purox No. 21 Cutting Attachment with 2 cutting tips and adapter

per construction and are so designed that the head angle can be adjusted easily as desired. Tips Nos. 2, 4, 6, 8 and 10 are furnished as standard equipment.

The Purox No. 21 cutting attachment is designed for use with the No. 11 welding torch to cut metal up to 2 in. in thickness. It is furnished with one- and two-piece Purox cutting tips. The weight of this attachment is 1 lb. 8 oz.

An adaptor is also available, which makes it possible to use the Purox No. 21 cutting attachment with the Purox No. 20 welding torch.

Milburn Type RIF-A Cutting and Welding Torch

Tips from torches of other makes can be used interchangeably on the type RIF-A cutting and welding torch developed by The Alexander Milburn Co., 1416-1428 West Baltimore St., Baltimore, Md. This torch is identical in construction with the type RI combination cutting and welding torch, with the exception of the torch head. This head is designed to take conical seated cutting tips Nos. 1 to 8 RIF, which will also fit the "Purox" Type E cutting torch. Furthermore, the cutting torch can be converted into a welding torch by the use of an adaptor, No. 630, which is designed to take standard Milburn Type FX welding tips. These tips will also fit Purox welding units 10 to 20, and the Prest-O-Weld Type W101 welding torch.

The principal parts of this torch are of forged bronze and the tubes are of nickel silver. It has a patented leak-proof, high-pressure valve. The seats may be removed without disassembling the handle or other parts.

Peerless No. 3 Special Burring Machine

The City Machine & Tool Works, East Third at June, Dayton, Ohio, has developed a special "Peerless" No. 3 burring machine for removing the burr in chamfering an automotive steering gear sector. This operation is done at the rate of approximately 460 pieces per hour, as contrasted to the slow and expensive hand filing method. A continuous but variable-speed, rotation of the turret is employed. After the set-up, the operation simply resolves itself into loading and unloading the parts.

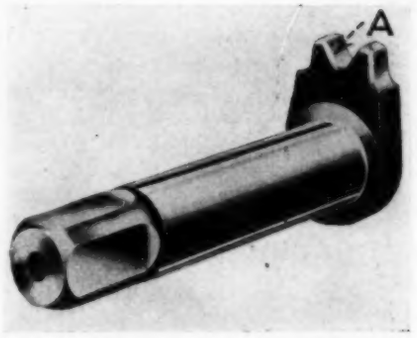


Fig. 2—Automotive steering gear sector, which is chamfered at *A*

The cabinet-type base adds to the rigidity of the machine, and all mechanisms are also completely inclosed. Each function of the machine is driven by a separate motor wherever possible. The turret is easily reached for loading and unloading work. In setting up the machine it is merely necessary to locate the machine and make electrical connections to the conduit fitting at the left.

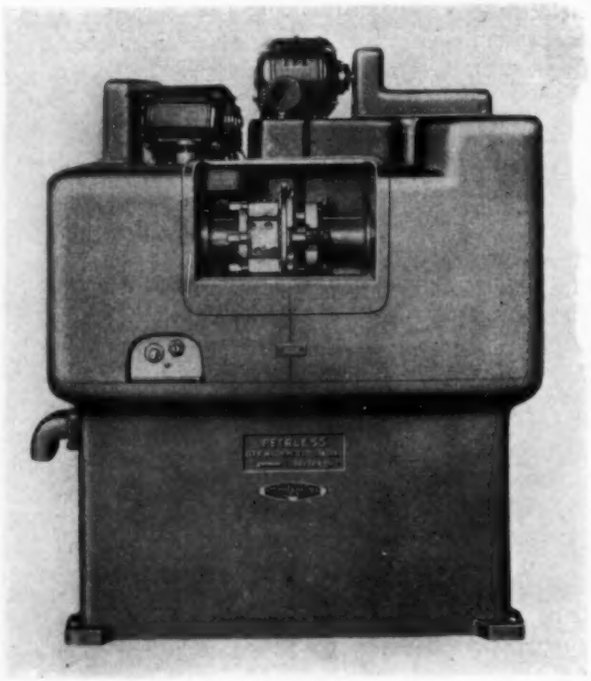


Fig. 1—"Peerless" No. 3 Special Burring Machine for burring an automotive steering gear sector

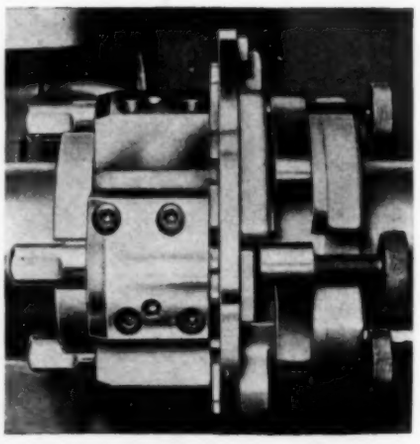
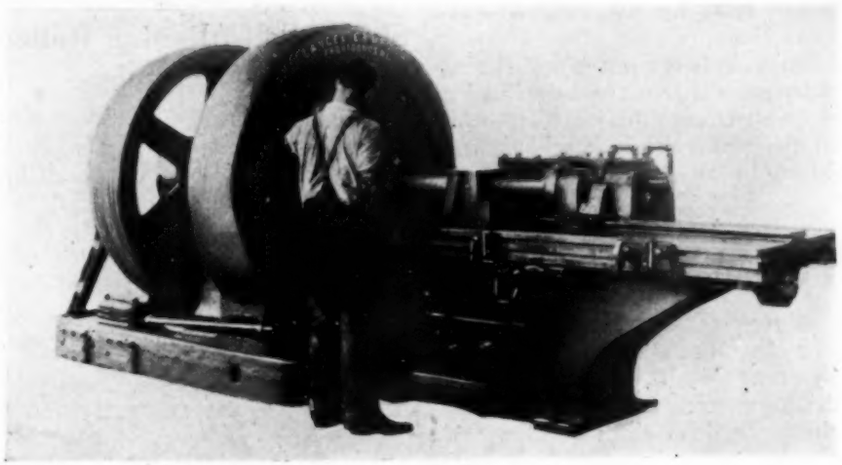


Fig. 3—Close-up of the turret which rotates continuously but at variable speeds

Langelier Redesigned No. 8, 9-in. Swaging Machine



Langelier Redesigned No. 8 Swaging Machine of 9-in. capacity which handles a maximum tube length of 96 in.

A redesigned No. 8 swaging machine has been announced by the Langelier Mfg. Co., Providence, R. I., as the largest of its kind ever built, not only in actual size but in capacity as well. This machine is capable of tapering and reducing work up to a finished diameter of 9 in., occupies a floor space of 6 ft. wide by 16 ft. long, and weighs 40,000 lb. The spindle is driven by a 5-ft. sheave, which also acts as a flywheel, and is powered by a 50-hp. motor mounted on a sliding base on a separate foundation. Seven 1¼x⅞-in. V-belts are used. This spindle revolves at 150 r.p.m. in bronze bushings in the head and back bearing, the flywheel being mounted on a tapered portion of the spindle between the two bearings.

Fourteen sets of the Langelier type of fixed head rolls are employed in the machine, these rolls being carried in a high-carbon-steel head ring. This arrangement permits 2,100 die blows on the work per min. Die opening is controlled by stop rods engaging the full length of the hammer blocks. The spindle slot is lined on the sides and rear with plates of special hardened steel. Hammer blocks, dies, hammer-block rolls and head rolls are made of special alloy steels hardened and ground. Both the dies and the machine are arranged for handling the work either hot or cold.

Force feed lubrication is maintained while the machine is running by a vane type pump. The oil is discharged through two leads, one supplying lubricant through the hollow spindle, and the other directly to the head rolls.

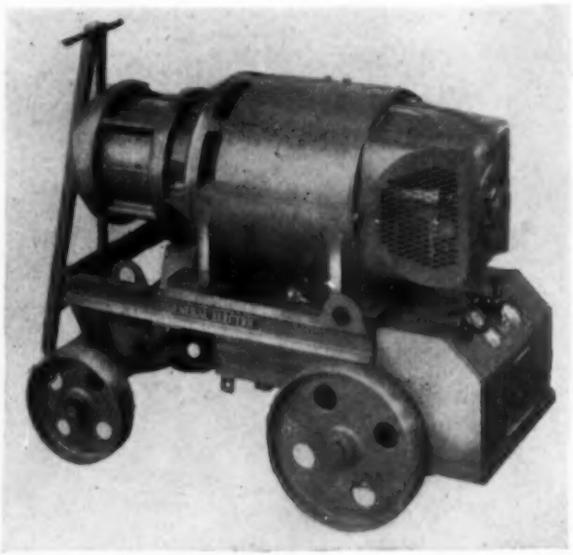
The holder is a separate unit and is attached to the machine base so as to produce correct alignment. The gripping jaws are operated automatically by the saddle travel, which controls a valve in conjunction with an air cylinder. The jaws open at the outward end of the stroke for loading or unloading and close at all other positions. A work stop unit takes the feed thrust and is adjustable for any length of tube.

The saddle is actuated by a hydraulic cylinder having a stroke of 42 in. which is the longest length of work possible in one operation. The greatest over-all length of tube which can be handled is 96 in. Dogs on the front of the saddle are capable of being positioned to produce automatically the proper cycle of rapid traverse, feed and reverse. A hand control lever provides the operator with positive control throughout the cycle. An Oilgear pump, direct connected to a 5-hp. motor mounted on a separate base, delivers hydraulic pressure at 1,000 lb. per sq.in. to the cylinder. The feed rate is adjustable from 0 to 240 in. per min. Positive stops are provided for use in swaging long tapers where two or more operations are necessary.

General Electric Type WD-20 Welding Sets

Single-operator welding sets in 100-, 200-, 300-, 400- and 600-amp. ratings have been placed on the market by the General Electric Co., Schenectady, N. Y. These welding sets are components of the WD-20 line and include both portable and stationary types. Models are available for operation on either a.c. or d.c. at all standard voltages and, in the case of a.c., standard frequencies and 2- and 3-phase gas-engine-driven sets are available.

Among the principal advantages of this line of welding sets are the use of two-bearing construction on the a.c. types up to 600 amp.; compactness and light weight, and improved welding characteristics. The sets are self-excited with a tapped series field for major current adjustments and



a shunt-field rheostat giving duplex voltage control. The latest design of standard a.c. motor has been specially adapted for use in these sets. Generators are of improved design and the d.c. motors are likewise of recent design.

Among other features of this equipment are: Practically instantaneous voltage recovery from short circuit to nearly full open circuit voltage, thus giving a quickly responsive arc; duplex voltage control by the operator over a wide range, with the particular provision of a surplus voltage which can be used when it is necessary to use very long welding leads, and simplicity of operation.

Nut Tapping Attachment for Brown & Sharpe Screw Machines

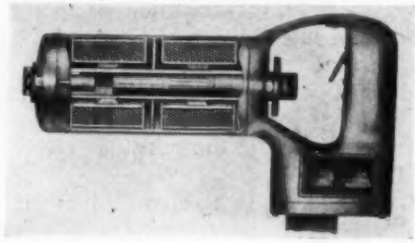
The Brown & Sharpe Mfg. Company, Providence, R. I., has announced the addition of a nut tapping attachment to its line of screw machine equipment. The attachment is made in three sizes for use on the Nos. 00, 0 and 2 machines, both the regular and high-speed types, and also on the screw threading machines. The attachment is of the second-operation type and is fastened to the machine above the front cross-slide.

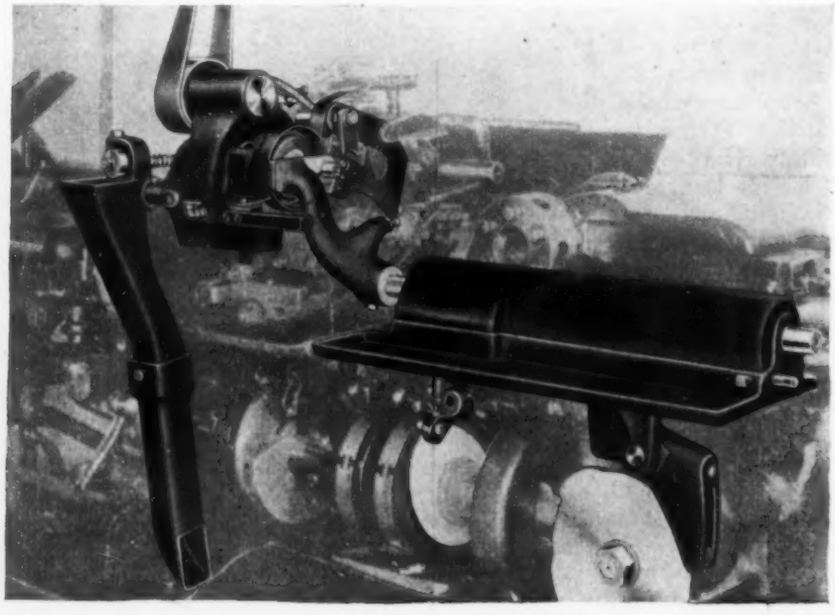
A transporting arm takes the part, after it has been cut off at the main spindle of the machine, carries it to an intermediate position where a counter-sinking operation is done on the back end, and then to the tapping unit proper. Here, the nut is placed in a revolving chuck and automatically fed over a bent shank tap. As successive nuts are fed along the tap, those previously tapped are pushed along the shank and dropped into a chute.

On belt-driven machines the attachment is driven from overhead or by an attachment driving stand, while on the motor-driven machines it is driven by an individual motor.

Syntron Electric Hammer

A reciprocating-type electric hammer has been developed by the Syntron Co., Pittsburgh, Pa., for drilling concrete floors for setting machinery, and for riveting, calking and chiseling operations. It is available in sizes for drilling $\frac{5}{8}$- to 2-in. holes in concrete. The piston is the only moving part and is reciprocated by two powerful electric magnets wound around the barrel of the hammer.

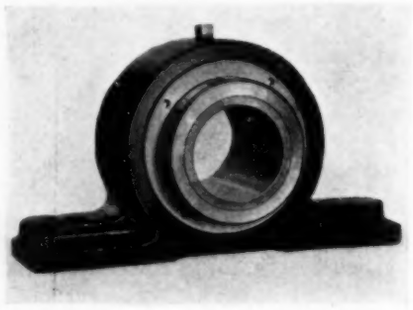




The tool produces 3,600 blows per min. A double rectifier is contained in the hammer controller and changes the alternating current into two pulsating currents displaced in phase by 180 deg.

Shafer Self-Aligning Roller Bearing Units

A line of self-aligning roller bearing units for normal-duty applications has recently been developed by the Shafer Bearing Corp., 6501 W. Grand Ave., Chicago, Ill. The company's double-row, self-aligning roller bearings, as used in standard-duty units, are now avaiable in these lighter weight, compact, simpler housings.



The normal-duty units are furnished as pillow blocks, flange units, and take-up units, in a full range of shaft sizes from $\frac{3}{4}$ to 3 in.

The inner race of the bearing is extended on one end only and fastened to the shaft by a special locking collar. Sealing is accomplished by a grease seal consisting of two steel stampings pressed into the housing or cover and having between them a $\frac{3}{32}$-in. fiber washer.

These stock units are self-aligning, without extra charge. Because of the concave-roller, convex-raceway assembly, the bearing carries the full load and rolls freely at the extremes of its self-aligning action. The bearing compensates automatically for minor inaccuracies in machining, in mounting, or deflection of the shaft.

The pillow blocks have two bolt holes for all units. The flange unit may be bolted at the side of a machine frame without machining. It can also be used as a step bearing for vertical shafts. Three bolts are used on the smaller sizes, and the larger units require four.

EQUIPMENT ADAPTATIONS

RECENTLY DEVELOPED BY THE MAKERS

Hanna Special Riveting Machines for Agricultural-Implement Wheels

Two single-purpose riveters for fabricating wheels of agricultural implements have been developed by the Hanna Engineering Works, Chicago, Ill. The machine shown in Fig. 1 is used first for attaching the spokes to the rim. Two $\frac{3}{8}$-in. cold rivets are driven simultaneously with 50 tons pressure applied on the duplex dies. Before each stroke cycle of the rivet dies, the riveter jaw must enter between two spokes and drop behind the rim flange. To accomplish this the wheel rotates and moves to and from the riveter, and the riveter jaw moves up and down. A roller nest truck provides the wheel movement and a pneumatic jack swings the riveter on trunnions to provide the vertical movement of the jaw.

The riveter shown in Fig. 2 is then used to attach spokes to the hub. Before each stroke cycle of the rivet dies, the riveter jaw must enter selectively into one of the inclosures bounded by the rim, two spokes and the hub of the wheel. The wheel must then be moved toward the riveter so that the jaw hooks in behind or above the hub flange. These movements are provided for by a carriage in which the wheel lies flat. The wheel rotates in the carriage so that the inclosures or openings are brought into index with the riveter jaw. The riveter jaw is then moved up and down by means of a pneumatic jack mounted in the carriage. The carriage moves horizontally on four wheels mounted in a stationary stand and is actuated through a bell crank handle. The vertical movement also serves to nest the manufactured head of the rivets into the jaw die and to clamp the spoke firmly against the hub before the rivets are driven. The wheel rim is forced into a ring which makes it round, central with the hub, and normal with the hub axis.

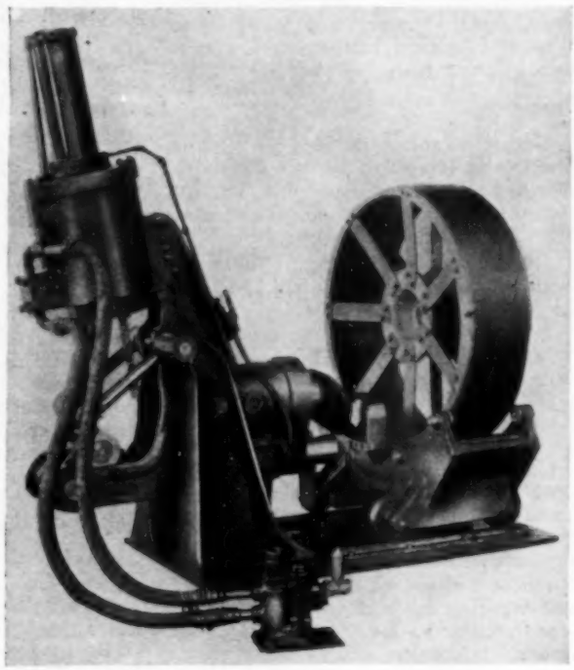


Fig. 1—Hanna Special Riveting Machine for attaching spokes to the rim of an agricultural-implement wheel

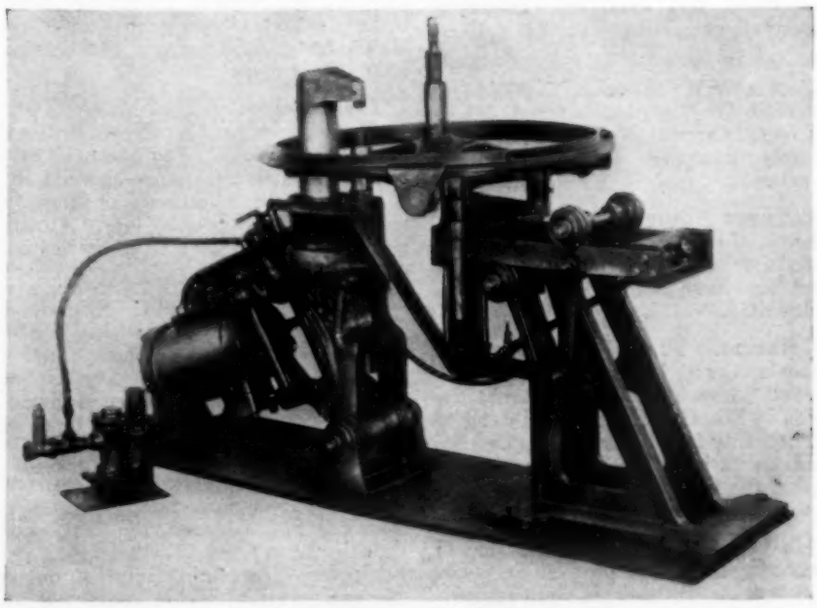


Fig. 2—Hanna Riveter for attaching the spokes to the hub

PATENTS

JULY 28, 1931

Metal-Working Machinery

Rotary Casting Machine. Edward W. Smith, Philadelphia, Pa. Patent 1,816,059.

Grinding Machine. Roger N. Heald and Waldo J. Guild, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,816,082.

Apparatus for Punching Shapes From Sheet Metal. John M. Hothersall, Brooklyn, N. Y., assigned to American Can Co. Patent 1,816,150.

Grinding Machinery. Clement Booth, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,816,170.

Valve Grinder. Clement Booth, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,816,171.

Flying Shears. Lane Johnson, Ingram, Pa., assigned to United Engineering & Foundry Co. Patent 1,816,187.

Automatic Feeding Apparatus for Sheet Metal Working Machine. Carolus Levon Eksergian, Detroit, Mich., assigned to Edward G. Budd Manufacturing Co. Patent 1,816,319.

Gear Cutting Machine. Maxwell H. Hill, Rochester, N. Y., assigned to Gleason Works. Patent 1,816,375.

Gear Cutting Machine. Maxwell H. Hill and Leonard O. Carlsen, Rochester, N. Y., assigned to Gleason Works. Patent 1,816,376.

Treadle Operated Centering Machine. John J. Thacher, Wethersfield, Conn.,

assigned to Pratt & Whitney Co. Patent 1,816,410.

Swaging Apparatus. James A. Lewis and Earl K. Holmes, Cleveland, Ohio, assigned to Steel and Tubes, Inc. Patent 1,816,488.

Machine for Filling Flasks for Founding. Walter F. Piper, Chicago, Ill., assigned to The Beardsley & Piper Co. Patent 1,816,612.

Geared Roller Wedge Riveter. John C. Hanna, Chicago, Ill., assigned to Hanna Engineering Works. Patent 1,816,677.

Crank Grinding Machine. Amos P. Steiner, Paul Stoner and Charles P. Harrison, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,816,750.

Means for Packing Sand in Foundry Molds and Cores. Morten Grindal, Motala Verkstad, Sweden. Patent 1,816,774.

Machine for Developing Aluminum Into Particles. Wilmer Charles Gangloff, Cincinnati, and Milton A. Conner, Mariemont, Ohio, assigned to The Drackett Chemical Co. Patent 1,816,806.

Tools and Attachments

Mold. Isaac Q. Gurnee, Butler, N. J. Patent 1,816,011.

Testing Device for Cylinders. Adolph Storm, Minneapolis, Minn., assigned to Storm Manufacturing Co. Patent 1,816,061.

Chuck. Lucius E. Whiton, New London, Conn. Patent 1,816,105.

Soldering Apparatus. Carl Helle, Brunswick, Germany, assigned to Elektrische Lot und Schweisz-Gesellschaft mit beschranketer Haftung, Brunswick, Germany. Patent 1,816,115.

Chuck Operating Mechanism for Machine Tools. Edward P. Burrell, and Fred H. Bogart, Cleveland Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,816,209.

Chuck Closing and Opening Mechanism. John J. N. Van Hamersveld, Cleveland Heights, and Edward P. Burhell, Shaker Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,816,239.

Gage. Franz Winny, Stuttgart-Botnang, Germany, assigned to the Firm: Julius Geiger G.m.b.H., Stuttgart, Germany. Patent 1,816,244.

Portable Clinching Tool. Carolus L. Eksergian, Philadelphia, Pa., assigned to Edward G. Budd Manufacturing Co. Patent 1,816,318.

Method and Means for Forming Internal Flanges on Tubular Bodies. Charles Boye, Warren, Ohio, assigned to The Stevens Metal Products Co. Patent 1,816,357.

Means for Gaging Material. Florence C. Biggert, Jr., Crafton, Pa., assigned to United Engineering & Foundry Co. Patent 1,816,464.

Roll-Holder for Rivet Spinning Machines. George A. Linley, Trumbull, Conn. Patent 1,816,490.

Shaping the Meeting Edges of Curved Blanks in the Manufacture of Sheet Metal Pipes and the Like. Walter Reginald Hume, Melbourne, Victoria, Australia. Patent 1,816,534.

Tool Slide or Reaming Attachment. Alfred E. Drissner, Cleveland, Ohio, assigned to The National Acme Co. Patent 1,816,571.

Punch Connecting Mechanism. Charles B. Gray, Millbourne, Pa. Patent 1,816,648.

Chucking Mechanism. Frederick H. Ragan, Cleveland, Ohio, assigned to The Columbia Axle Co. Patent 1,816,655.

Speed Indicator. Burchard P. Romain, South Orange, N. J., assigned to Weston Electrical Instrument Corporation. Patent 1,816,748.

Processes

Method of and Apparatus for Making Sheets and Irregular Surface Contours. Joseph Ledwinka, Philadelphia, Pa., assigned to Edward G. Budd Manufacturing Co. Patent 1,816,594.

Method of Galvanizing. Julian L. Schueler, Kokomo, Ind. Patent 1,816,617.

TRADE PUBLICATIONS

CHAINS. The American Chain Co., Inc., Bridgeport, Conn., has available a book on standard types of sling chains, giving specification tables, definitions, cautions and instructions governing the purchase and use of chain. A chart of safe working loads of iron sling chains when used at various angles is also included.

CONTROLS. The General Electric Co., Schenectady, N. Y., has issued Catalog GEA-606C for 1931 on "Industrial Controls," comprising 196, 8½ x 10-in. pages.

DRILLING MACHINES. The Western Machine Tool Works, Holland, Mich., has issued Circular No. 70 on "Western Radials Equipped with Twin Disk Clutches."

FOUNDRY EQUIPMENT. The General Electric Co., Schenectady, N. Y., has issued a bulletin entitled "Electric Equipment for Foundries," being known as bulletin GEA-1413.

GRINDERS. Farrel-Birmingham Co., Ansonia, Conn., has available a booklet entitled "Assuring Production with Precision in Roll Grinding," which explains the necessity for close accuracy and fine finish in various types of rolls, and describes the features of its several types of roll grinders.

HEAT-TREATING FURNACES. H. O. Swoboda, Inc., 3400 Forbes St., Oakland Station, Pittsburgh, Pa., has published bulletin No. 260, dated June, 1931, and superceding bulletin No. 190, on continuous electric furnaces for heat-treating ferrous as well as non-ferrous strip metal and wire. The bulletin describes the "Falcon" furnaces designed for treating razor-blades, saw-blades, surgical knives, springs, and similar articles.

METAL TOOLS. The Whitney Metal Tool Co., Rockford, Ill., has issued several catalog pages on its No. 9 button punch, No. 36 shear, No. 28 foot press, and No. 70 sheet metal bench.

MOTORS. The General Electric Co., Schenectady, N. Y., has issued a series of revised bulletins on various types of its motors as follows: Bulletin GEA-61C, superseding 61B, on Type CD constant-speed d.c. motors; GEA-712B, superseding 712A, on Type BTA motors of the adjustable-speed, a.c. brush-shifting type; GEA-752A, superseding 752, on Type BD d.c. motors of constant-speed and adjustable-speed design; GEA-894, superseding in part 223, on Type CD, adjustable-speed d.c. motors; GEA-1296A, superseding 1296, on Type CR9517 brakes for d.c. motors; GEA-1326A, superseding 1326, on type K, totally-inclosed, fan-cooled induction motors; GEA-1341A, superseding 1341, on explosion-proof, totally-inclosed fan-cooled induction motors; GEA-1383, superseding 1303A and 6A, on general-purpose, squirrel-cage induction motors with open, horizontal frames, and GEA-1412, superseding 456, on type K, solid-shaft vertical induction motors.

PLASTIC PRODUCTS. The General Electric Co., Schenectady, N. Y., has issued a bulletin entitled "Plastic Products Price List," being bulletin GEA-937B, superseding 937A. A discount sheet is included.

SPEED REDUCERS. The General Electric Co., Schenectady, N. Y., has issued bulletin GEA-1437 on built-in speed reducers for general-purpose, ball-bearing induction motors.

TAP MANUAL. The Morse Twist Drill & Machine Co., New Bedford, Mass., has issued a "Tap Manual," giving practical information relative to the construction and methods of employment of various styles of taps. An important section is devoted to lubrication of taps.

TOOLS. The Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has published Catalog C-231 on "Ex-Cell-O Carboloy Tipped Tools," with a complete range of dimensions, types and tips. Several types of special tools are also shown.

WELDING ROD AND EQUIPMENT. Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill., has issued Bulletin W entitled "Welding Rod and Equipment," containing information on gas and electric welding rods and all types of portable welders.

CONSTRUCTION OF STANDARD TIME CHARTS

IN ORDER to operate any incentive wage system at minimum expense, many "short-cut" methods are necessary; some may be aided by alignment charts. There are several methods and formulas for the construction of an alignment chart scale; the logarithmic seems best, however, for practical application.

To construct a logarithmic scale, the logarithms of the maximum and minimum values of the series of numbers (or of functions) are taken, together with the logarithms of any intermediate values which it is desired to designate, then an arithmetical scale is constructed for these logarithms; but the numbers themselves (not their logarithms) are assigned to the points so determined.

Suppose it is desired to construct a logarithmic scale 10 in. long for numbers ranging from 1.25 to 12.500. The first step is to find the logarithms of these terminal values, and from these determine the modulus.

Let M = Modulus
L = Length of desired scale in inches
X_1 = Maximum log function desired
X_2 = Minimum log function desired
F = Log function.

$$\text{Then } M = \frac{L}{F(X_1) - F(X_2)}$$

Example:

Let $L = 10$ in.
$X_1 = \log 12.5$
$X_2 = \log 1.25$

Substituting these values in the formula:

$$M = \frac{10}{\log 12.5 - \log 1.25} = \frac{10}{1.00691 - 0.10069}$$

$$M = 11.035$$

The arithmetical scale is to be 10 in long, numbers range from 0.100691 to 1.00691, and the modulus is 11.035. To locate any intermediate point "X," first find log X, deduct 0.10069, and then multiply by modulus value 11.035. The result is the distance (in inches) from the left end of the point corresponding to the number "X." Stated algebraically, if L_1 denotes the distance in inches from the left end of a point corresponding to the number "X":

$$L_1 = 11.035\ (\log X - 0.10069)$$

Suppose the values of "X" to be designated on the scale are 2, 3, 4, 5, 6, 7, 8, 9 and 10. For convenience, a table is prepared in which these numbers appear in the first column; in the second are their logarithms; and in the third are the differences between these logarithms and the logarithms of the initial number of the series (corresponding to the left end of the scale); in the fourth column are the products of these differences by 11.035, which converts these differences into distances in inches. The required table is:

X	Log X	Log X—0.10069	L_1
2	0.30103	0.20034	2.211
3	0.47712	0.37643	4.154
4	0.60206	0.50137	5.5326
5	0.69897	0.59828	6.602
6	0.78815	0.68746	7.586
7	0.84510	0.74441	8.21456
8	0.90309	0.80240	8.8544
9	0.95424	0.85355	9.4189
10	1.00000	0.89931	9.9238

The logarithmic scale in Fig. 1 was developed from above tabulated figures. However, for a "short cut" method, a logarithmic scale may be constructed by taking logarithmic values from the tables of logarithms, starting from No. 1 and up, taking any value and plotting it to the desired scale.

The scale in Fig. 2 is plotted from the table of logarithms as follows:

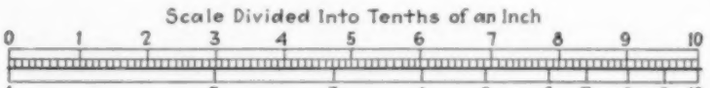
	A		B	C
Log	10	=	0.0000	1
	20	=	3.0103	2
	30	=	4.7712	3
	40	=	6.0206	4
	50	=	6.9897	5
	60	=	7.8815	6
	70	=	8.4510	7
	80	=	9.0309	8
	90	=	9.5424	9
	100	=	10.0000	10

Plotting the values is done by reading on the linear scale, reading logarithmic values "B" and recording figures under "C."

Logarithmic scales may be taken direct from the slide rule very conveniently, provided the desired length of the linear scales will suit the problem.

As an example of the above methods for development of the logarithmic scales, the accompanying hobbing time chart was constructed. The first problem was to plot scales for obtaining the cutter approach, for variable depths of cut and diameter of cutters. The reason for not making cutter approach in conjunction with the cutting time chart is to make it applicable to any job that may be hobbed or milled in the form, such as gears, splines or keyways; regardless the depth of cut, pitch or diameter of cutter.

1 Required Scale



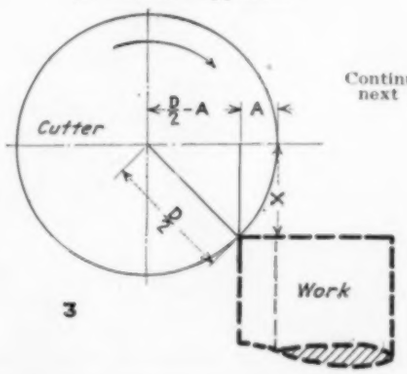
2 Required Scale

It is understood that the progressive time study department has established standards, such as handling time feeds and speeds for different materials and classes of work. This chart is used in conjunction with the standards described and enables the time study department to determine actual cutting time for any conditions.

In order to understand the construction of the chart, the mathematical formulas were developed as follows from Fig. 3 for cutter approach:

$$X = \sqrt{A(D - A)}$$

Let D = Diam. of hob or cutter
A = Depth of cut or tooth
X = Cutter approach



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Continued on next page

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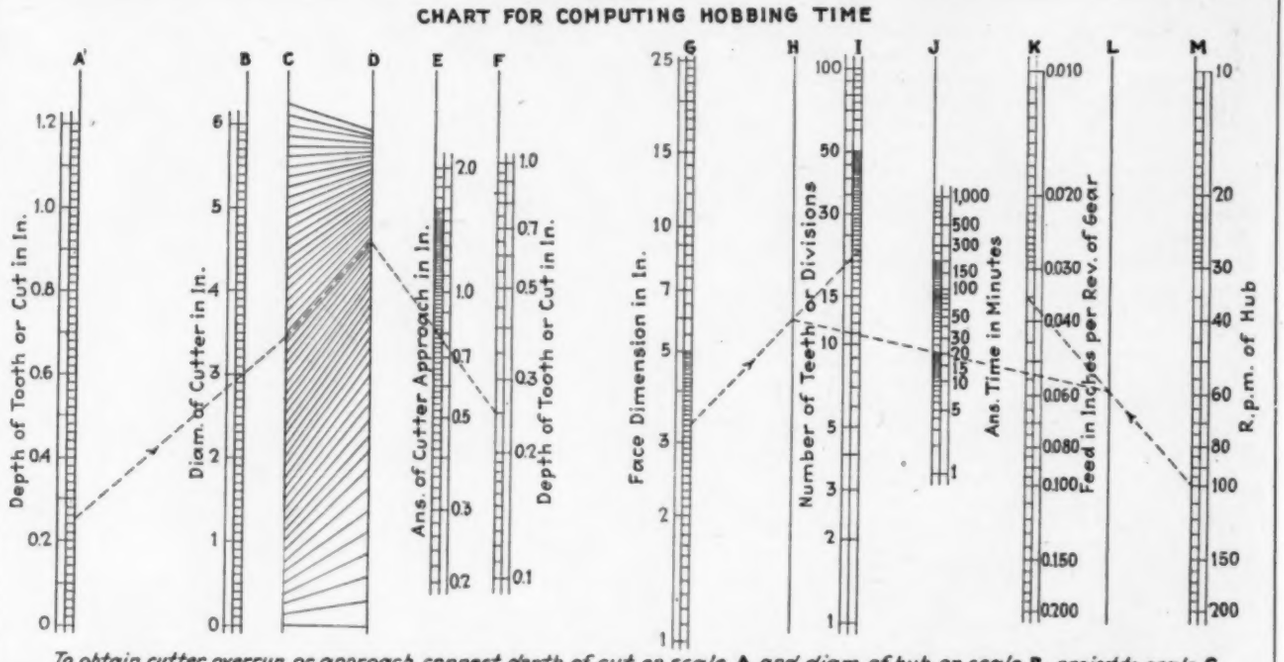
CONSTRUCTION OF STANDARD TIME CHARTS—Continued



To obtain cutter overrun or approach, connect depth of cut on scale **A** *and diam. of hub on scale* **B**, *project to scale* **C**, *from scale* **C** *follow conversion line to scale* **D**, *project from scale* **D** *to scale* **F**. *The intersection on scale* **E** *cutter approach is read.*
To obtain cutting time add to dimension of face cutter approach and find point on scale **G** *and connect with point on scale* **I**. *The intersection point on scale* **H** *is noted. Now connect feed point on scale* **K** *with point on r.p.m. scale* **M**. *The intersection points on reference lines* **H** *and* **L** *are connected and time is read on scale* **J**

From Fig. 3, solving for X geometrically:

$$X = \sqrt{\left(\frac{D}{2}\right)^2 - \left(\frac{D}{2} - A\right)^2}$$

$$= \sqrt{\frac{D^2}{4} - \left(\frac{D^2}{4} - \frac{2DA}{2} + A^2\right)}$$

$$= \sqrt{\frac{D^2}{4} - \frac{D^2}{4} + DA - A^2}$$

$$= \sqrt{A(D-A)}$$

The hobbing time formula is: $T = \dfrac{N(L+X)}{FR}$

Where T = Time in minutes
N = Number of teeth or divisions
L = Length of cut or face
X = Cutter approach $\sqrt{A(D-A)}$
F = Feed in inches per rev. of job
R = R.p.m. of hob or cutter

Example:
The following data are given:

Part	= Gear
Material	= No. 3140 SAE Steel
Pitch	= 7/9
Number of teeth	= 22
Pressure angle	= 20 deg.
Face	= 2½ in.
Depth of tooth	= 0.250 in.
Feed used	= 0.035 in.
R.p.m. of hob	= 100
Hob diam.	= 3 in.

Solving for cutter approach by substituting the values in the formula:

$$X = \sqrt{A(D-A)}$$
$$= \sqrt{0.250(3 - 0.250)}$$
$$= 0.827 \text{ in.}$$

Now solving for time required to cut the teeth by substituting the values in the formula:

$$T = \frac{N(L+X)}{FR}$$
$$= \frac{22(2.500 + 0.827)}{0.035 \times 100}$$
$$= 20.91 \text{ min.}$$

In obtaining the same results from the accompanying chart, follow the instructions given on the chart and the connection lines indicated with arrows. The same result may be computed in a fraction of the time the mathematical way.

One must not overlook that the accuracy of the result desired will depend on the proper connection of points on the chart scales. The chart reading is the actual cutting time. Handling and allowance time are not included, since these vary in different plants. Therefore, when establishing standard time, add these variables to chart time.

When a multiple thread hob is used, divide the number of teeth on the gear by the number of threads on the hob and proceed in the usual way for computing the time.

There are numerous similar cases where alignment or graphic charts may be applied to save considerable time and energy in the rate-setting department.

Contributed by Walter V. Sovitzky, Industrial Engineer, Le Roi Company

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AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

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The Challenge to Management

Problems of human welfare increase as men concentrate in factories instead of being scattered over the land. As civilization becomes more complicated, management becomes more important. The extent to which the human element must be recognized as a vital part of management programs has been and is being seen more clearly during recent months. Never before has management taken such a keen and genuine interest in the welfare of its employees, and this is one of the most hopeful signs for the future.

While there is still much to be done in improving mechanized functions of industry, such as better coordination of effort, stabilized production, cheaper distribution and waste prevention, the human element is the chief problem and offers the greatest challenge to management. Nor can this phase be entirely separated from production for it has a far greater effect on production costs than may appear on the surface. The human element is more than ever the point to be considered by management, and largely because it is more difficult to find men who can utilize men to mutual advantage than men who can secure machine efficiency.

One of the most difficult phases of the human problem is the wide variation in the capacities of individuals. Capacity includes ability to learn various operations, to use judgment in running or assembling machines, to assume responsibility or display initiative, and other characteristics that vary not only with the individual himself but with the ability of management to get the most out of the man or men, individually or as a group. Industrial engineers too often make plans on the basis of a high uniform efficiency which can seldom be realized. They forget that if we employ only the highly efficient, the others must be taken care of in idleness unless we let them starve or introduce the lethal chamber for the inefficient.

Management, to be worthy of the name, must take the "run-of-mine" in employees, utilize average men and women in production plans. It must, if necessary, take a hand in the education of the boys and girls who will grow up to be producers —and not with a narrow viewpoint but to fit them into industry and life as a whole. In fact management must look beyond particular industries and consider the effect of its policies on the general welfare. For unless all sections of the nation are getting their shares of the benefits of our great mechanical advancement the whole structure is in danger.

Management has done much in utilizing men and methods efficiently. It must do more in coordinating different activities, in preventing the over emphasis of any particular phase of business. Business is now so interdependent that extreme individualism must give way to cooperative planning and execution. Here lies the great opportunity for management in the future and a genuine challenge.

Why Do Machines Vary?

Do machines in the same lot and made with the same tools and fixtures vary, and why?

Users of almost any machine from an automobile to a vacuum cleaner are more or less aware that all machines of a given model do not give the same results. Some locomotives have the reputation of being good steamers, certain automobiles get black eyes from some drivers and high praise from others. How much of the difference in satisfaction is due to differences in the machine and how much to the user?

There is, however, little doubt as to some variations in finished machines. As parts have presumably passed inspection both as to finish and tolerance, and there is no reasonable evidence of

perversity in metals, real differences in product would seem to be chargeable to assembly. Small particles of dirt, bearings put together dry instead of with an oil film before they are mated, bruised corners on mating parts, slight misalignments or too tight adjustment of bearings can all affect the performance of any kind of a machine. Then too the way in which a machine is tested may affect its future operation. A few minutes abuse by an inexperienced operator can cause no end of trouble later.

All of which suggests that it might be economical to spend a little more time and money in the assembling department. For even with parts that are commercially interchangeable there is still more of the personal element involved than many of us think. It might save a lot of grief if we used a higher grade man in assembling slides and bearings than is sometimes the case. Some find it advisable to put the older men on work of this kind, their experience and dependability counteracting any difference in speed and being cheaper than trying to satisfy disgruntled customers after the machine is sold.

Much of the trouble with machines is undoubtedly due to the way in which they are handled. But careful assembly helps greatly in maintaining a reputation for good work.

◂◂ CHIPS ▸▸

It becomes increasingly possible to see the European situation in undistorted perspective . . . international conferees and financiers go back home convinced that Germany is well able to take care of herself . . . the Germans seem to feel the same way about it . . . morale goes up; agitators begin to look for jobs of work . . . England, congenitally less vocal about her own troubles, accepts a 225,000,000 dollar credit from the Federal Reserve Bank of New York and the Bank of France . . . share and share alike . . . France has less unemployment than the city of Akron, Ohio . . . likewise Italy.

Further signs of improvement in America . . . few recessions . . . Studebaker shows improved production and earnings . . . six automotive concerns announce that they will not close down for the usual annual vacation this summer—Chevrolet, Pierce-Arrow, Studebaker, Auburn, Durant, and Federal Truck . . . the first forty-four railroads to report for June show net operating income of 33,000,000 against 28,000,000 for May, an increase of eighteen per cent . . . likewise eighteen per cent is the increase in power output of Associated Gas & Electric for the week ending July 18 over the same week in 1930.

Mark August 10 on your calendar. . . Silver Bay Institute Meeting, Lake George, N. Y. . . see complete program on page 260h.

General Electric announces a million dollar transformer order . . . Westinghouse Electric & Manufacturing has increased operations during the last few weeks and is recalling workers.

DREAMING ON ROLLERS

It seems, according to the "Armstrong Whitworth Record," that an automobile assembler dreamed a dream. He was at his superintendent's funeral. He saw the casket being borne by six of his fellow-workers. Suddenly the superintendent sat up and roared, "If you fellows would put rollers under this damn box, five of you could get back on the job."

Allis-Chalmers announces acquisition of American Brown Boveri and Condit Electrical Mfg. Corp. . . . they secure thereby several new lines of equipment . . . Baldwin Locomotive buys certain subsidiary companies of Cramp-Morris.

Trans-Atlantic flying season is on full swing . . . Hats off to Boardman and Polando, Herndon and Pangborn . . . some of these days we are going to refuse to look when the "Los Angeles" swings around the building . . . Mrs. Hoover will christen the airship "Akron" this coming Saturday.

Metal working exports look up . . . though prices are lower, June 1931 shows 4,865,470 dollars as against 3,374,897 in June 1930 . . . they exceed May of this year by 2,000,000.

H. P. Anderson becomes chief engineer in charge of engineering, inspection, testing and development, Standard Stoker Co. . . . George H. Kublin advances to chief engineer, Auburn Automobile Co. . . . O. F. Stroman takes the reins as sales manager in charge of the industrial department, Westinghouse Electric & Mfg. Co. . . . F. Hugh Morehead, chief engineer of Walworth Mfg. Co., is elected vice president in charge of engineering.

General Machinery Corp. acquires the business of Putnam Machine Co., formerly owned by Manning, Maxwell & Moore, Inc. . . . the Putnam line will be manufactured in conjunction with that of Niles Tool Works, another General Machinery subsidiary.

THIS WEEK IN *AM*

Leading off the editorial section is to be found the first installment of "Optics in Metal Working," by Ken G. Niblack, of Bausch and Lomb. He takes up the toolmaker's microscope and makes it understandable. For the first time since he began physics in high school, this previewer is made to comprehend the fundamentals underlying an optical system. If you have passed this article by, turn back to page 225.

One small part of a textile machine requires extruding, swaging, turning, drilling (page 229). C. J. Dorer, chief tool designer, White Sewing Machine Corp., opens up the bag of tricks he has collected in many years of die practice (page 233). A. F. Shore, of the Shore Instrument & Mfg. Co., is represented by "Hardness Testing for Superhard Materials"—tungsten carbide and the like (page 238). C. R. Ranney, of Jones & Lamson Machine Co., describes advanced designs of grinding fixtures for threading dies (page 241). R. A. Shaw, well known safety engineer, states the case for adequate mechanical guards (page 246).

"Small Shop Economies" and "A New Line on Cylinder Blocks" are both completed in this informative number.

MORE DECENTRALIZATION

The sale by General Motors of the Ottawa, Ill. plants of the National Plate Glass Company to the Libby-Owens-Ford Company is another example of a changing business policy. For a time, it appeared that our industrial giants, in their efforts to be self-contained, would soon control every part of their output from the raw material source to the consumer.

Now it appears that some of these economies have proven fictitious. Purchases from independent sources are often more economical than manufactures by a subsidiary. The indications are that this decentralizing program by large concerns will continue, a trend which will probably result in a sounder manufacturing set-up.

The Libby-Owens-Ford Company has no connection with the Ford Motor Company.

CONTROL WITHOUT STOCK RECORDS

Not so many years ago, even in industries dedicated to mass production, manufacturing was on a lot basis, and stock requisitions were made out for each item withdrawn from stores. Inventory was on a liberal basis to provide for contingencies. Requisitions were posted every day. That meant clerical work and a lot of it. Later on, requisitions were accumulated for a week at a time and posted as totals; that meant less clerical work. Still later, a month's accumulations were posted as totals—still less clerical work.

Now, purchases are made strictly according to manufacturing schedule, and for most items of stock, placed at the initial machines without being charged into and out of a rough stores account. Cumulative purchase orders are compared with cumulative production releases. The stock chaser has a copy of the purchase order and the receiving report. No stock keeper, no clerks; they have all been placed on more productive work.

• COMING •

When Walter N. Polakov was asked to reorganize a Soviet Russian machine tool plant, production was tied up into tangled knots. Across the luncheon table he told us how order had been brought out of chaos. Coffee grew cold while we listened to his story. Right there we secured his promise to write a similar story for the readers of *American Machinist*. It appears next week under the title, "A Case of Management Installation in U.S.S.R."

And by chance rather than by design, another eminent Russian-American, John P. Nikonow, has prepared for the same issue an excellent monograph on the value of patents. He intimates that it may become a chapter in a book he is preparing.

It is anything but strange that radium holds just as much mystery for the layman as it did the day it was discovered by Dr. and Mrs. Curie. How its penetrating gamma rays are being turned to industrial uses will be the subject of a special article by Dr. Robert F. Mehl, of the U. S. Naval Research Laboratory.

Three weeks hence we shall have ready something very practical and definite on the more prosaic X-ray. W. H. Shipman, of Babcock and Wilcox, will show how every foot of their many rods of welds are X-ray-inspected.

Progress in Metal-Working and Machinery Markets

DETROIT, with July running ahead of June, and August expected to be better than July, is the sole exponent of business upturn. Other districts are in the midst of an accentuated period of summer stagnancy, and expect no relief until fall, and perhaps late fall at that. The reason remains the same—too many business advisors and not enough business leaders. Needed machines remain unpurchased in a period of excellent prices and deliveries because financially minded executives maintain a stranglehold on company pursestrings, let come what may.

NEW YORK awaits action on Navy and municipal inquiries, with little new developing. Cincinnati's sales are of single items to miscellaneous buyers. One builder of large tools received several promising inquiries; others received a small number of scattered single inquiries, including some from the Navy. Detroit says auto production will hit its low point in August because of numerous plant shutdowns for vacations. Chrysler, however, plans to build 30,000 Plymouths during the month. New England has government, school and electrical prospects, though postponements have played havoc with some well-substantiated expectations.

CHICAGO expects August to be the year's lowest month. Some school business may be closed shortly, but other orders do not follow inquiries. Canadian demand is fair for tools for mining and hydraulic machinery companies, but is spotty in other lines. General construction is quiet and automobile plants are running part time, but the autumn is expected to bring an upturn. Pacific Northwest, however, is not such a believer in Santa Claus; they expect little before next year, with industrial demand nil and all plants curtailed. Southern District shares the general quiet.

NEW YORK

Navy and municipal prospects still hang fire, with little new developing to relieve a stagnant summer situation. The Navy is expected to close its 17-lathe order momentarily, and the subway list has not yet been issued. Bids were opened July 30 on 15 machine tools for the College of the City of New York, but awards have not yet been announced.

CINCINNATI

The water is so low in the business river that the machine tool packet is scraping bottom. Principal buyers were general machinists and miscellaneous users whose needs were single tools. Selling agents noted no change. Additional single inquiries came from the Navy Department. A maker of large tools received several inquiries, some of which he expects to close quickly. Other manufacturers received a small number of well-scattered and well-diversified inquiries, most of which are for single tools.

DETROIT

July business in the machinery and machine tool trade ran slightly ahead of June, and prospects for August indicate that it will exceed July. Business is exceedingly quiet, with an added air of expectancy while the Ford plant is shut down for annual vacation during the entire month of August. A revised Model A is generally expected to make its appearance with the resumption of activities Sept. 1, but as usual Ford officials are silent.

Auto production will hit its low point in August, with Ford and several other plants down all or part of the month. Chrysler is continuing to run, its Plymouth unit exceeding capacity production and a plant addition under construction. August production is planned at 30,000 units. Several other plants, including Hudson and Packard, will probably run throughout the month.

NEW ENGLAND

Each week is remarkably like its predecessor; totals are small without substantial orders to indicate a definite trend. This very low level of business is likely for some weeks to come.

Postponements have raised havoc with some well-substantiated expectations. At present, school manual training departments, government demands and fair business in prospect from the electrical industry create all the new interest. Plans of the Electric Boat Co., Groton, includes machinery purchases. Garages are taking single machines.

CHICAGO

Business in machine tools for the month of July will register a lower level than has been touched this year. Buying is limited to necessities, and while inquiries for single tools continue there seems to be no disposition on the part of prospective buyers to close. It is the consensus of opinion that no improvement is within the bounds of probability until fall is well advanced. The Chicago Board of Education seems finally to have reached a definite decision with regard to closing on the long held up Austin High School list. The same applies to the small list of tools of the Jackson, Jr., High School.

CANADA

There is a marked tendency on the part of machine tool dealers in the Dominion to take a philosophical view, as there are innumerable indications of a turn for the better during the autumn. Demand continues fair for tools used in mining equipment and hydraulic machinery plants, but in most other lines buying is very spotty. Larger manufacturing interests are still but lightly employed. General construction activities are at a low ebb, and automotive plants are still working on part time. June production of automobiles was the lowest of any month this year.

PACIFIC NORTHWEST

There has been no improvement during the last month, and prospects do not indicate any notable upturn during the remainder of 1931. Machine tool and shop equipment houses are marking time. July's total will be less than June's. Industrial demand is practically nil, as shops and factories are either running at greatly reduced capacity or are closed. Logging and lumbering are having a protracted mid-season shut down and production is only about 35% of capacity. Canners are having a curtailed season. Houses dealing in power shovels and road equipment have had a fair season. Governmental requirements are the only source where machine tool and shop equipment houses have recently found any business.

SOUTHERN DISTRICT

General quietness characterized the past fortnight. Although sales were considerably behind expectations for the beginning of the third quarter, recovery from the early July slump was reported almost generally.

Chief buying centers were quiet. Sales in the Atlanta, New Orleans, Birmingham and Houston territories were all reported as dull, with business limited to scattered orders from outlying sections. Industrial activity has been better, but has been only lightly felt by machinery and machine tool jobbers. Used machinery and equipment stocks are about steady with fluctuating prices reported.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

The international conference held at London does not seem to have had much effect. Financiers representing the conferees appear to have gone back home convinced that Germany will have to take care of herself. So far as it can now be discovered, this is what Germany intends to do. The experience is likely to be good for her, and in a few years she will probably be thankful that she has learned to walk alone financially. Of course, her progress may be slower than might otherwise have been the case, but she will be stronger for the effort she will have to make, and no one has ever doubted her industry or ingenuity.

Of course, the pessimists will be gloomy. They always are, but hard work is a wonderful specific for choler, and those who have food to eat and clothes to wear can find a good deal of joy in life if they are constructively at work.

It is difficult to say just how Germany will employ herself during the coming winter, but it is evident that a new spirit has taken hold of the people, and that it is likely to enthuse the whole nation. So imbued it does not need much sympathy, and the indications are that within a year or two Germany will be as prosperous as was France shortly after the Franco-Prussian War. Therefore, it is hardly necessary to dwell upon the troubles that may be ahead for the people who formerly composed the German Empire. Of course, they will have trouble. Everybody does, but they will probably extricate themselves more quickly than any other nation in the world, and find themselves struggling up the hill of difficulty at an amazingly rapid pace.

Centers Shifting

Meantime, the centers of trouble seem to have shifted to England and Russia. We are really ignorant of Russia's condition, but the whole world knows of England's predicament. She is boldly trying to be the financial Atlas of the reconstructed universe, and she has a heavy load to carry. But it is well to recollect that Atlas has always managed to sustain the universe despite its weight, and that the history of the past provides us with the only data from which we can draw any conclusions.

Then there is America. Of course, the universe is important, and Central Europe has long considered itself an essential part of the Aryan cosmogony, but to Americans the United States is the most important part of all the world, and if the outlook is reasonably cheerful here the American business man is not much disturbed by conditions elsewhere.

Therefore, it is satisfactory to report that there is a scattered improvement in business in the United States, and that the indications favor its extension, in the near future. The most striking evidence of this is the report of the Studebaker Automobile Company, issued last week. It shows a substantial gain in earnings, and bespeaks a most optimistic view of the future.

The action of the United States Steel Corporation last week in reducing the dividend on its common stock instead of passing it removed one source of uncertainty that has hung over the market. It is significant that no reduction of wages was recommended by the directors, though a readjustment of salaries of officials and other salaried employees was urged.

Advance in Silver

Then there is the advance in silver, small, it is true, but probably connoting the action of Mexico in inhibiting further exports of gold and a British Treasury Order which is interpreted to mean that England will find ways to check further shipments of gold to China, thereby forcing silver into circulation. In so far as the phraseology is concerned it is a clever bit of work, but it is only fair to say that the interpretation put upon it comes from the bi-metallists rather than the "gold bugs."

But Great Britain has as yet made no attempt to check the flow of gold to Europe or America beyond the rise in the Bank rate, and something over $160,000,000 was shipped from London to New York and Paris last week. All sorts of rumors with regard to this shipment were current. Most people maintained that it was the proceeds of a credit arranged two or three years ago, and that the gold shipped would soon be coming back. But it doesn't really make much difference, and we are probably approaching the time when the world's entire supply of gold will be kept in London, Paris and New York, and transferred when necessary by simple book entries.

Meantime, credit is abundant. In London a second advance in the bank rate to 4½ per cent was ordered, but there is no scarcity of money, and all those who require funds for legitimate reasons are accommodated.

In the past such conditions have nearly always led to advancing markets, and there seems to be no reason why this should not be the case at present. Of course, it will take a little time for the financial world to get over the chill that the word "moratorium" always causes. This is not surprising, for it means a dead debt, which may ultimately come to life. Therefore, it is important to note that the Hoover moratorium has been agreed to, and that consideration of the resurrection of the dead debts will probably be the next influence that the markets will feel.

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THE BUSINESS WEEK

August 5, 1931

The lengthening list of the seven plagues of depression—widespread wage and dividend reductions, debt moratoria and defaults, strikes, drought, grasshoppers, politicians, bitter-end deflationists and optimistic forecasters—is about completed, and Pharaoh should soon be willing to let business out of bondage if some as yet anonymous Moses will emerge from the bullrushes to lead it . . . The depressing influence of foreign factors has lifted for a while, giving way this week to dismal inferences from steel dividend reductions and wage cut rumors . . . These woeful forecasts are, however, not wholly warranted by the facts, even though our index reflects some further recession in trade activity in July . . . Steel production itself, turning upward slightly out of season, seems to be joining other industries responding to diversified consumer demand . . . This stimulation from current consumer replacement needs is reflected also in the steady unseasonal upswing of electric power output . . . Even construction, the key to recovery, continues to resist further decline . . . The close fluctuations of commodity prices also lend some encouragement to those who believe that this summer's slackness will see the end of prolonged stagnation in the domestic scene and that slow improvement is scheduled to start in the fall . . . Unfortunately the financial forces necessary to assure progressive recovery in the basic industries during the next six months have not yet been brought into play.

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Material Trends and Prices . . . .

The operating rate of the steel industry advanced two points, to 32 per cent of capacity, this week, at a time of the year when recession is the rule. It is possible that 30 per cent of capacity does not adequately meet requirements of the market. Non-ferrous metals showed no inclination to shake off the spirit of indifference which, of late, has pervaded the market in these materials.

(All prices as of July 31, 1931)

IRON AND STEEL

Pig Iron—	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$12.00	$12.00	$12.70
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	16.20
Heavy Melting Steel Scrap— Pittsburgh consuming point, No. 1, per gross ton	10.50	10.00	14.75
Furnace Coke—Connellsville, per net ton	2.40	2.40	2.50
Foundry Coke—Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes—Pittsburgh, base, per 100 lb	1.60	1.65	1.65

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Iron Machinery Castings—Cost in cents per lb. of 100 fly-wheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

Chicago.....4.62½ Cleveland.....4.50 New York.....4.75
Cincinnati.....4.40 Detroit.....4.00

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Steel Sheets—Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10*	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

* Light plates.

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Seamless Steel Tubing—Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall	Outside Dia. in Inches: ½	⅝	¾	⅞	1	1¼	1½
Inches B.w.g.	Price per Foot						
.035 20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc.—Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel—Hot-rolled bars, base, Pitts., cents per lb:

Chromium, 15%, carbon 0.12% and under	19.00
Chromium, 15 to 18%, carbon 0.12% and under	20.50
Chromium, 18 to 23%, carbon 0.12% and under	23.00
Chromium, 23 to 30%, carbon 0.12% and under	28.00

Bolts and Nuts—Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots ..... 73@10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:

Aluminum ingots, 99%, N. Y.	23.30
Copper, electrolytic, Conn	7.75
Copper wire, base, Chicago and Cleveland	10.12½
Copper wire, base, N. Y.	10.00
Lead, pigs, E. St. Louis	4.22½
Tin, Straits, pigs, spot, N. Y.	24.25
Zinc, slabs, E. St. Louis	3.87½

Prices following are in cents per lb., base, N. Y., Chi. and Cleve:

Brass rods, high	13.75
Brass sheets, high	15.50
Brass tubing, high	20.37½
Copper, drawn round	16.37½
Copper sheets	17.87½
Copper tubing	20.37½

Prices following are in cents per lb., del. from N. Y. warehouse:

Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	44.00
Solder, bar	18.87½

Prices following are in cents per lb., base, Huntington, W. Va:

Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals—Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	3.00	4.25	4.00@4.25
Light brass	2.12½	3.25	3.25@3.75
No. 1 rod-brass turnings	3.50	4.50	4.00@4.50
Heavy copper	5.50	5.75	6.25@6.75
Light copper	4.50	5.00	5.50@6.00

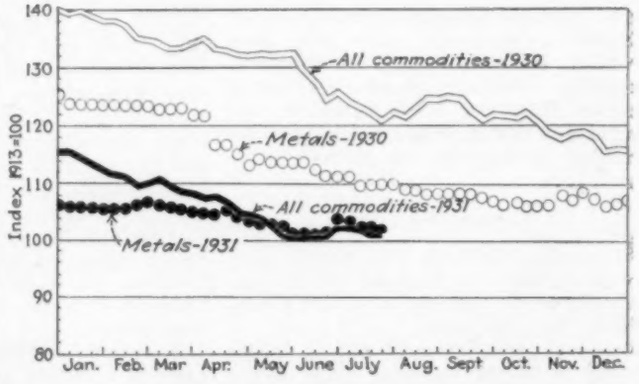
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide mineral, cloth, 6-in. dia., No. 1, less than 200, per 100	$4.36	$4.59	$4.59
Belting, leather, heavy, discount	30@10%	40%	40%
Belting, rubber, trans., 1st grade, discount	60–10–10%	60–10%	60%

Lumber—Per M ft., b.m., 16 ft. lengths, del., N. Y:

Crating—Southern pine:
1x4-in..... $27.00 1x6-in..... $26.00

Skids—Spruce:
2x4-in..$45.00 3x3-in..$46.00 4x6-in..$48.00 6x6-in..$52.50



Price Indexes Week by Week
(6 Metals and 74 Commodities—Figures from The Annalist.)

NEWS

HENRY P. FLETCHER

Metal-Working Machinery Exports Show Striking June Upturn

PAUL WOOTON
Washington Correspondent

A striking advance in the volume of exports of power-driven metal-working machinery occurred in June. The value of exports in that month was $4,865,470. In June, 1930, the figure was $3,374,897. The increase is even greater than is indicated by the valuation, since prices were lower in June of this year than was the case in June, 1930. June exports exceeded those of May by $2,000,000.

Increases were well distributed throughout the list. The detailed figures, just compiled by the Bureau of Foreign & Domestic Commerce, follow:

	June 1930	June, 1931
Engine lathes	$131,657	$312,645
Turret lathes	289,319	93,180
Other lathes	136,240	125,295
Vertical boring mills and chucking machines	94,968	70,584
Thread cutting and automatic screw machines	73,803	123,708
Knee and column type milling machines	111,998	81,609
Other milling machines	287,117	438,890
Gear cutting machines	131,930	295,540
Vertical drilling machines	65,313	98,269
Radial drilling machines	61,668	57,521
Other drilling machines	73,657	410,204
Planers and shapers	92,385	76,577
Surface grinding machines	20,609	110,872
External cylindrical grinding machines	149,111	263,329
Internal grinding machines	32,550	128,234
Tool grinding, cutter grinding and universal grinding machines	77,083	80,458
Other metal grinding machines	97,714	188,018
Sheet and plate metal-working machines	399,862	289,704
Forging machinery	155,739	490,658
Rolling mill machinery	99,279	47,808
Foundry and molding equipment	268,988	649,387
Other power driven and metal-working machinery and parts	523,807	433,069
Other metal-working machinery	314,896	417,897

Domestic exports in the machinery group as a whole in June were larger than in May. June exports in this category were valued at $43,549,694. This is an increase of $1,311,012 over May. While the June valuation is more than $20,000,000 less than the value of all exports of all machinery in June, 1930, the decline is not as great as is indicated by the value, as prices are lower and the quantity of machinery exported was not greatly less than that in June of last year.

Limited to industrial machinery, there was a material increase in the exports for June, as compared with those for May. The June total for that group was $15,863,358, as compared with $12,819,102 in May. The June total is only $5,000,000 under that of June, 1930. Certain items of exports, even on a basis of value, show decided increases over June of last year. Some of these examples are: water wheels and water turbines; dredging machinery; mine hoists and derricks; ore crushing and sorting machinery; concentrating and smelting machinery; engine lathes; thread cutting and automatic screw machines; gear cutting machines; drilling machines; grinding machines; forging machinery; textile winding machines; silk machinery; sawmill machinery; ice making equipment; cotton gins and cotton presses; water meters; accessories and parts for generators; instrument transformers; power switches and circuit breakers; electric locomotives; portable electric tools; electric ranges; radio sets and spark plugs.

Automobile Production Shows June Decline

Automotive production in June totaled 249,462 vehicles, compared with 315,115 in May, a decrease of 65,653, according to figures made public by the Department of Commerce. The passenger car output was 207,798 as against 269,080 in May, truck production dropped to 41,304 as against 45,695, while taxicab production increased to 360 from 340. Output for June was 85,044 below that of June, 1930.

Total motor vehicle production during the first six months of 1931 was 1,568,478, as compared with 2,198,580 in 1930. Passenger cars total 1,310,435, as compared with 1,860,361 in 1930; trucks, 255,227, as compared with 333,591, and taxicabs, 2,816, as compared with 4,628.

Fletcher to Resign As Tariff Head

Having succeeded in raising the Tariff Commission from its low estate in public opinion, Henry P. Fletcher will retire Sept. 15. The new appointee will be a man from out of the West or possibly a New England Yankee. Only two members of the Commission hail from west of the Mississippi. The Pacific Northwest and New England want representation. New England's candidate, probably, will be Thomas O. Marvin, high rank protectionist and chairman prior to reorganization of the Commission a year ago.

Mr. Fletcher, diplomat and gentleman farmer, has not posed as a tariff expert and is glad to be rid of an unpleasant job. Lacking authority to act independently, the Commission's effectiveness as an instrument of tariff revision is limited by White House policy. But Fletcher, with the cooperation of his associates, has made the Commission an efficient operating unit and to that extent has contributed to placing tariff-making on a scientific basis. The old commission, riven by controversy, was able to accomplish little.

The value of Fletcher's services can not be judged merely by the 22 reports submitted since last September. The eventual result of one of the Commission's current investigations may be a fundamental change in tariff technique, if not in policy, a tariff based on and adjusted to the domestic instead of foreign value of imports.

Erie Railroad Moves Offices

With the departure of a special train carrying members of the Erie Railroad engineering staff and their families for Cleveland on July 28, the company began moving its headquarters to Cleveland. Within two months control of the Erie will be shifted to the home of O. P. and M. J. Van Sweringen, who together have majority ownership of the line. The Erie's offices at Sixth Ave. and Twenty-Third St. and its executive offices at 50 Church St., New York City, will be abandoned. About 1,000 employees are involved in this change. Erie's headquarters in Cleveland will not be housed with the executive offices of the other Van Sweringen lines, but in the Midland Bank Building and another building.

Drill Jig Design Contest Announced

The American Machinery & Tools Institute, 40 North Wells St., Chicago, has announced a competition for designers and toolmakers for the design of the best drill jig in each of several types specified to be used as model jigs in the standardization work of jigs by the institute. Certificates of merit for the best three designs submitted for each type will be awarded as judged by a committee of engineers of national importance. The sketches or drawings are to be placed in a preliminary review by Oct. 30. The ten best of each type will then be selected and finished drawings requested to be placed in final judgment Nov. 30. Full information may be had by addressing the institute.

General Machinery Buys Putnam

The General Machinery Corporation, Hamilton, Ohio, has acquired the business of the Putnam Machine Co., Fitchburg, Mass., formerly owned by Manning, Maxwell & Moore, Inc., New York, N. Y. The Putnam line of products will be manufactured at the General Machinery Corporation's plants as supplementary to the line of the Niles Tool Works Co., another subsidiary of General Machinery. The company is prepared to furnish repairs for all existing Putnam, Dietrich & Harvey, and Beaman & Smith installations. The business will be conducted as the Putnam Machine Co., division of General Machinery Corporation. G. A. RENTSCHLER, president of General Machinery Corporation, is also president of the Putnam Machine Co.

Federal Specifications

A Federal specification is being proposed for electrical metallic tubing. Federal Specification QQ-I-651 on gray iron castings has been issued to succeed USGMS 141, QQ-M-161 on anti-friction metal castings and ingots to succeed USGMS 536, QQ-S-681 on steel castings to succeed USGMS 170 and GGG-F-671 on hacksaw frames to succeed USGMS 479.

Studebaker Reports

The Studebaker Corporation and subsidiary companies had a better three months in the period ended on June 30 than in 1930 both as to net profits and volume sales, according to the official report of the company made public recently. Net profits, after reserves for Pierce-Arrow minority stockholders' interest, amounting to $1,219,605, compared with $915,275 last year, a gain of $304,330, or 33.3 per cent. After deducting preferred dividends the earnings in the June quarter of this year were equal to 56 cents a share on the common stock compared with 41 cents a share in the corresponding period of last year. For the six months ended on June 30, net profits were $2,029,355, or 91 cents a share, compared with $2,258,702, or $1.03 a share last year.

Program Announced For Silver Bay Meeting

That the large registration by industrial executives in all branches of industry for participation in the various discussions on plant operation and management to be held during the 15-day session of the Silver Bay Industrial Institute for 1931, indicates that American industry realizes more clearly than ever before the need for definite and more complete knowledge of factory processes and supervision, is the declaration of Charles R. Towson, secretary of the Institute, in outlining the complete program for this year's Conference.

An important feature of the Institute this year will be the first Conference of Smaller Industries which will be addressed by Gov. FRANKLIN D. ROOSEVELT of New York, former Secretary of Commerce and Labor Charles Nagel of St. Louis, JAMES W. HOOK, chairman of the Connecticut State Emergency Committee on Employment; GILBERT T. HODGES, president, Advertising Federation of America; JOHN E. ALCOTT, Associated Industries of Massachusetts; FRANK E. REDMOND, Associated Industries of New York State; VIRGIL JORDAN, economist, and others. The Institute program is divided into four main divisions, Supervisors, Plant Training, Personnel and Small Plants, the latter meeting from Aug. 10 to Aug. 15, the other three following from Aug. 15 to Aug. 25. The Institute will be conducted at Silver Bay, N. Y., on Lake George.

The divisions devoted to Supervisors, Plant Training and Personnel will constitute an "industrial college" with outstanding executives and experts representing many lines of industry as the teachers and leaders of discussions, and with supervisors, foremen, plant training experts, personnel directors, and department heads as the pupils. Chairmen of these three divisions are: Supervisors—R. N. KEPPEL, Standard Oil Co. (N. J.), and M. J. KANE, American Telephone & Telegraph Co.; Plant Training—W. M. NELSON, General Electric Co.; Personnel—C. R. DOOLEY, Standard Oil Co. of New York. The subjects to be discussed in the Personnel Division include, among others, employment, wages, accident prevention, stabilization of employment, health, benefits and insurance, education and training, group relations.

American Machinist Awards

Four more entries, one from the Pacific Coast.

Twenty-six days to go, but they include three solid substantial business weeks. Though the contest to determine the most effective equipment replacement policies must close September 1, 1931, as planned, there is still plenty of time to prepare the winning entries. There is gold at the end of these two rainbows, two pots of five hundred dollars each, plus public recognition for the two winners.

SUGGESTED SCHEDULE

During the week of August 10, file your entry at this office, assemble data on your policy and select proofs of its effectiveness. Take your photographs.

Week of August 17, prepare a preliminary draft of your brief and secure any necessary approvals.

Week of August 24, put your presentation into final form and mail it to the "Chairman of the Committee on Awards," care of *American Machinist*, McGraw-Hill Publishing Co., New York City.

British Exports Show Continuation Of Decline of Last Two Years

BY OUR LONDON CORRESPONDENT

Figures relating to overseas trading of Great Britain during the past six months show a continuation of the decline. Imports at £417,873,843 were down by £123,815,426, as compared with the first six months of 1930; exports of produce and manufactures at £199,155,979 declined by £105,695,273; re-exports, that is exports of imported merchandise, valued at £35,708,271, fell by £13,571,279; so that total exports were valued at £234,854,250, or were £119,266,552 lower than for the first six months of 1930. The imports were, in fact, of less than four-fifths the value of the corresponding 1930 imports, and exports of British production were at two-thirds the total values of 1930.

Machinery imports were valued at £7,297,061, a decrease as compared with the first half of 1930 of £2,477,160. Here only one sub-section, namely, agricultural machinery, at £358,974, as compared with £338,442, showed any advance. Prime movers, not electrical, at £285,467, were just about half the value of corresponding imports for 1930, electrical machinery at £738,470 compared with £986,699, and imports of electrical goods and apparatus, not including electrical machinery, were valued at £2,382,621, a decline of more than £1,000,000.

Machine Exports Drop a Third

The value of machinery exported is £16,991,848, or a little more than two-thirds of the value for 1930. Agricultural machinery, at £474,982, was of rather less than half the value exported in 1930. Boilers and boiler-house plant at £1,607,499, showed a small increase, and the value for cranes, etc., at £787,817, was somewhat less than two-thirds the corresponding 1930 figures. Electrical machinery was exported to the value of £2,218,935, or rather more than two-thirds of the 1930 value, the most pronounced decline (£350,443) being in the Australian market. The countries of Europe accounted for £524,052, about a quarter of the exports, and countries in South Africa for £236,238, or more than one-tenth. Prime movers, not electrical, were sent abroad to the value of £1,663,068, or rather more than three-quarters of the value of 1930, and although the French market, at £58,731, was rather more than maintained, all other areas show a falling away except the Soviet Union of Russia, where exports nearly doubled, being valued at £320,406. Textile machinery was exported to the value of £2,587,210, as compared with £4,819,816, machinery for spinning and twisting accounting for £1,889,812. For textile machinery, Europe as a whole (£1,035,182) and British India (£849,067) remain the best customers, with China (£212,711) and countries in South America (£125,232) following. The value of these exports to the United States is entered at £80,778. The re-exports of machinery are relatively unimportant, the total value being £659,883 as against £853,828 in 1930.

Machine tools were imported to the value of £707,313, with re-exports at £27,458, so that the net import of machine tools was £679,855. On the other hand, British machine tools to the value of £883,366 were exported, and deducting the net imports, net exports were valued at £203,511. The decline in the export of machine tools during the six months under review, as compared with the six months of the previous year, was £93,150, while the decline in machine tool imports was £287,731, and in re-exports the increase was £3,071.

Although machine tool exports to British India were fairly well maintained (£133,064 as against £137,919), trade with the British area in South Africa (£39,355), and Australia (£11,276), showed a marked drop. But the value of the continent of Europe as a market for British machine tools again increased markedly, tools exported to this area being valued at £559,087, as compared with £444,520. It need hardly be said that Russia is mainly responsible.

It is fairly generally accepted that the main reasons for the commercial and industrial condition here lie in world economic conditions and the fall in prices, though critics and observers are not wanting who ascribe other causes for Great Britain's share in the trade collapse. The engineering industry in particular is certainly not fully occupied and, going to the base of matters, so far this year the production of pig iron and of steel ingots and castings is well "down," being 2,006,000 tons and 2,650,100 tons respectively, giving monthly averages of say 334,330 tons for iron, and 441,700 tons for steel, as compared with 516,400 tons and 608,200 tons in 1930 and 855,000 tons (iron) and 638,600 tons (steel) as the pre-war (1913) average.

Business Spasmodic

In engineering generally, business is often described as spasmodic. Development schemes are helping electrical engineers, and home orders, very largely for transformers and allied appliances, have been secured, though orders for overseas have not been as numerous as in the past. The extension of the use of electricity in Great Britain is shown by the returns of the electricity commissioners, authorized undertakings having generated during the first six months of 1931 some 5,630,000,000 units as compared with the figures (revised) of 5,421,000,000 units for the corresponding period of 1930. Electrical engineers, in fact, are fairly well placed, though one or two may need more business. The railway companies, in view of their financial position and their trading results generally, have been ordering in minimum quantities; in a number of instances supplies, for example locomotive tires, are at pre-war prices. Locomotive engineers cannot be described as in a satisfactory position: orders for export are wanting.

Motor Industry Off

According to a recent statement issued by the Society of Motor Manufacturers and Traders, the motor industry will not, it is anticipated, show any great decrease of production as compared with 1930. This, however, is hardly the general impression, and it is against such definite evidence as is available. For instance, for the six months ending with May last the total number of motor vehicles licensed, excluding tram cars and trade licenses, declined as compared with the same period of last year; again, in May last the total number of mechanically-propelled road vehicles registered for the first time was 28,515, as against 34,841 in May, 1930. Business has been mainly in the light car. There has certainly been a decline in the import of motor vehicles, and here, it is anticipated, a new low record will be registered this year. Last year, by the way, Great Britain produced 169,669 private cars and taxis and 66,859 commercial vehicles and omnibuses, the total being some 2,277 less than the high record of 1929; but this decline was entirely in private cars, etc., commercial vehicles showing an increase of 10,401.

The shipbuilding industry continues disappointing, for at the end of June the amount of shipping under construction was 555,603 tons gross, and part of this has been suspended. It is considerably less than half the volume at the same time last year. Much shipping is laid up and that is probably why, despite the needs of the shipbuilding industry, the government was unable to offer any help when shipbuilding orders for Russia were mooted recently. Employment in the engineering industry, particularly the electrical side, has undoubtedly benefited from the receipt of Soviet orders, and negotiations (unfinished) were recently reported regarding new orders for five million pounds' worth of heavy engineering productions.

In the foregoing the leading customers, or rather, classes of customer, for the machine tool industry here have been mentioned and the conditions noted. The industry has managed to maintain a moderately satisfactory condition of affairs, but for this it has been particularly dependent on Russian orders now being executed. While others have been discussed, it has not always been possible to come to terms. Russian orders have in fact been refused. The new Ford works at Dagenham is being equipped, and the first tool, a Pratt & Whitney jig borer, was actually put down a week or two ago.

Packing, Packaging Exposition in 1932

A second exposition on packaging, packing and shipping will be conducted by the American Management Association at the Palmer House, Chicago, throughout the week of March 7, 1932. It will be a broadening of the Packaging Exposition held in New York City in May of this year, and will be concurrent with, and a feature complementing, conferences on packing and shipping, packaging, production and consumer marketing which will be held on the same dates on the same floor of the Palmer House.

Standards

The American Tentative Standard Safety Code for the Protection of Industrial Workers in Foundries, approved by the American Standards Association in 1922, is now being revised in order to bring the code up-to-date and advance it to the status of American Standard. The revised code is being prepared under the sponsorship of the American Foundrymen's Association and the National Founders Association.

The ASA has just approved American tentative standard specifications for zinc-coated (galvanized) sheets of bessemer steel, open-hearth steel, and open-hearth iron. Five classes of zinc coatings applied by the hot-dip process are covered in the specifications.

BUSINESS ITEMS

The Baldwin Locomotive Works, Philadelphia, Pa., has purchased the subsidiary companies of Cramp-Morris Industrials, Inc., including: I. P. Morris & De La Vergne, Inc.; the De La Vergne Engine Co.; the Pelton Water Wheel Co.; the Cramp Brass & Iron Foundries Co.; the Federal Steel Foundry Co. The first three have become subsidiaries of the Baldwin-Southwark Corporation, which in turn is one of the principal units of the Baldwin Locomotive Works. Pelton will continue to operate as an independent unit with headquarters in San Francisco. The Cramp Brass & Iron Foundries Co. has become a subsidiary of the Baldwin Locomotive Works, while the assets and business of the Federal Steel Foundry have been acquired by Standard Steel Works Co., Burnham, Mifflin County, Pa., another subsidiary of Baldwin. Machinery operations of Morris and Cramp will, in due course, be moved from their present locations in Philadelphia to the Baldwin plant at Eddystone.

Multitex Corporation of America, a holding company capitalized at $1,000,000, has been organized under Delaware laws by a group of St. Louis men to launch a newly patented construction material known as glassteel, consisting of perforated sheet steel coated on both sides with glass. It is said to combine the qualities both of steel and glass so far as lightness, durability, carrying capacity and other advantages are concerned. Christian Andresen, inventor, is president; Eugene Geissler, vice-president; Otto E. Schroers, secretary, and the board of directors includes Anthony F. Ittner, H. F. Clemens, and the three officers. According to Mr. Ittner, it is a closed corporation, the plan being to license manufacturers in various parts of the country.

Fay & Scott, lathe manufacturers of Dexter, Me., are celebrating this year their fiftieth anniversary. NORMAN H. FAY organized the company in 1881 to manufacture a special wood-turning lathe for the making of peavies, a cant dog used by lumbermen. In 50 years, the company has had no labor trouble. The partnership was dissolved in 1896 by retirement of the junior partner. In 1900, the business was incorporated. W. L. FAY, son of the founder, is now president and P. S. PLOUFF vice-president.

The Toronto (Ont.) Industrial Commission announces that the Erie (Pa.) Resistor Corporation will shortly commence manufacturing operations in Toronto under the name Erie Resistor of Canada, Ltd. Manufacturing space has been leased at 49 Bathurst St. R. WEESE, Toronto, will be the company's Canadian manager.

Aluminium, Ltd., and the Aluminium Goods Mfg. Co. have formed a new Canadian company jointly, capitalized at $500,000, which will manufacture and distribute aluminum goods in Canada. The new company, known as Aluminium Goods, Ltd., has taken over a factory at Toronto where initial manufacturing operations will be centered.

The English Electric Co. of Canada, Ltd., has transferred its general sales department from Toronto to St. Catherines, Ont., to consolidate that department with the engineering and factory organizations. The office for the Toronto district will remain at its present address in the Northern Ontario Bldg., Toronto.

The Lyons Iron Works, Inc., Manchester, N. H., has purchased the Manchester Engineering & Welding Co., Inc., and will operate the plant as its Hayward St. branch. Work at the new plant will include electrical welding and gives the company 8,000 sq.ft. additional floor space.

The Simplex Tool Co., Woonsocket, R. I., has been taken over by the Simplex Corporation, and the new company will specialize on the manufacture of steel slide vises developed by the old company in 1924. The personnel of the new company is the same as the old and will operate in the same plant.

The Euclid Crane & Hoist Co., and the Armington Engineering Co., Euclid, Ohio, have merged to form the Euclid-Armington Corporation, Euclid, Ohio.

A plan for the reorganization of the General Laundry Machinery Corporation, now in receivership, has been proposed by the reorganization committee. The good-will and certain tangible items of the Tolhurst division of the corporation would be transferred to a new corporation to be controlled by American Machinery and Metals, Inc., in exchange for voting trust certificates for 22,000 shares of American Machine and Metals. The rest of the assets of the General Laundry Machine would be transferred to a new corporation to be known as the Columbia Troy Corporation, all the stock of which would be distributed among debenture holders and creditors of General Laundry.

Opening of a plant to serve the Maritime Provinces is announced by Corporate Steel Products, Ltd., Montreal. A provincial company is being formed under the name of Atlantic Steel Products, Ltd., and the industry will be located in the former British Canadian Packing Co. plant at East Saint John. Manufacturing operations will commence about September first, and it is expected that 100 persons will be employed at the start.

PERSONALS

H. P. ANDERSON has been appointed chief engineer in charge of engineering, inspection, testing and development activities for the Standard Stoker Co., Erie, Pa.

J. E. ARMSTRONG, president of the Armstrong Mfg. Co., Waterloo, Iowa, has been appointed receiver of the Associated Manufacturers' Corporation of America, also of that city, on application of Headford Bros. & Hitchins Foundry Co., another Waterloo foundry.

P. E. BLISS, president of the Warner & Swasey Co., Cleveland, Ohio, has been appointed a member of the newly organized Board of Observatory Visitors of the Perkins Observatory, Ohio Wesleyan University.

H. G. CHASE has been made manager of sales for the Standard Alloy Co., Cleveland. He was previously connected with the General Alloy Corporation, Boston.

W. G. KRUEGER, with the Chicago (Ill.) Pump Co. for many years, has been appointed Buffalo district manager with headquarters at 91 Tremont St., Kenmore, Buffalo. Other recently appointed district representatives are Edwin J. Richard, Cincinnati, O., for Cincinnati territory; Drake Engineering Co., for Dayton, O., district; Oklahoma Heating Supply Co., Oklahoma City, Okla., with R. I. Ludwig, sales manager, for the Oklahoma City territory; and R. W. Lamkin, Little Rock, Ark., and William C. Craig, Tulsa, Okla.

J. A. DOUCETT has been appointed vice-president and general sales manager of Revere Copper & Brass, Inc., with offices at 230 Park Ave., New York, N. Y. Mr. Doucett was previously vice-president and assistant gen-

eral sales manager, and before that was president of the Michigan Copper & Brass Co., in Detroit, now the Michigan Division of Revere. VINCENT W. ALLEN has been appointed manufacturing manager, to be located at the general offices in Rome, N. Y. He was previously works manager of the Michigan Division.

G. E. CLARK, formerly with the James H. Beans Foundry Co., Martins Ferry, Ohio, has been made general foundry foreman of the Youngstown (Ohio) Foundry & Machine Co.

WILLIAM DONALD, auditor of the Carnegie Steel Co., has been elected a member of the board of directors.

GEORGE H. KUBLIN, assistant chief engineer of the Auburn (Ind.) Automobile Co., has been appointed chief engineer.

H. O. MCCULLEY has been elected president of the Erie (Pa.) Belt & Nut Co., to succeed LINCOLN DAVIS, who retired recently.

CHARLES D. MACGILLIVRAY has been elected secretary of the Baldwin Locomotive Works, Philadelphia, to succeed the late Arthur L. Church. J. HARRISON KERST was elected assistant secretary. They were elected secretary and assistant secretary, respectively, of two Baldwin subsidiaries, Standard Steel Works Co., and Baldwin-Southwark Corp.

F. HUGH MOREHEAD, chief engineer of the Walworth Mfg. Co., Boston, Mass., has been elected vice-president in charge of engineering.

T. J. PACE has been appointed assistant to J. S. TRITLE, vice-president and general manager, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Since 1926 Mr. Pace has been director of sales. He joined the company in 1902.

DR. CHARLES L. PARSONS of Washington, business manager of the American Chemical Society and internationally known chemist, has been elected to honorary membership in the Society of Chemical Industry, the insignia of this distinction being presented by Prince George of England at the jubilee meeting of the Society in London. Dr. Parsons was the only American to be honored.

R. S. RUBINCAN has been elected president and general manager of the William A. Box Iron Works, Denver, Colo., to fill the vacancy caused by the death of William A. Box.

J. GRIFF SCOTT, formerly San Francisco district manager of the Buffalo (N. Y.) Forge Co., has joined the Herberts-Moore Machinery Co., 140 First St., San Francisco, newly appointed exclusive agent for Buffalo Forge. Mr. Scott will act as special representative of the latter company.

O. F. STROMAN has been made sales manager in charge of the industrial department of Westinghouse Electric & Mfg. Co. He joined Westinghouse in 1903 and since 1909 has been in the industrial sales department.

WARNER SEELEY, secretary of the Warner & Swasey Co., Cleveland, Ohio, has been appointed chairman of the industrial division, Cleveland community fund.

GEORGE R. WOODS, of R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N. Y., is sailing for Europe Aug. 15 on a business trip.

OBITUARIES

ELMER E. ARING, 38, purchasing agent of the Foote-Burt Co., Cleveland, died there July 27. He had been purchasing agent for the company for the past 13 years.

MARTIN J. CAPLES, 67, a former vice-president of the Seaboard Air Line Railway Co., and for forty-eight years identified with various railroads in executive capacities, died July 29, in Trenton, N. J.

SHERWOOD M. CHASE, 65, vice-president and general manager of the Chase Foundry & Mfg. Co., Columbus, Ohio, died July 20.

THOMAS DUNBAR, 67, mechanical superintendent of all shops of the Pullman Car & Mfg. Corp., Chicago, from 1909 until his retirement in 1916, and connected with the company for 31 years, died July 21 at his summer home at Elkhorn, Lauderdale Lakes, Wis.

JESSE B. GARBER, 69, for 32 years superintendent of the Deming Co., Salem, Ohio, and with the company since 1885, died recently as a result of an automobile accident.

HENRY NIEMANN, member of the board of directors, Enterprise Foundry Co., San Francisco, Calif., died there recently.

AMOS F. HARTZELL, 62, president of the Standard Oven Co., Pittsburgh, died suddenly in Baltimore July 27 of heart trouble induced by heat. He became affiliated with the Standard company 25 years ago when that firm was known as the United Oven Co. Ten years ago he became president.

WILLIS EDWARD HALL, a retired consulting engineer of Summit, N. J., died in Philadelphia, July 25, of heart disease.

LEO I. HEINTZ, president of the Heintz Mfg. Co., Philadelphia, died July 8.

JOHN A. HOWARD, 59, for many years chief engineer of the American Radiator Co., New York, died recently there.

HARRY M. REAM, 52, treasurer of the Steel Shot & Grit Co., Amesburg, Mass.; the Globe Steel Abrasive Co., Mansfield, Ohio; the American Steel Abrasives Co., Galion, Ohio, and the Kann-Pangborn Co., Pittsburgh, Pa., died in Pittsburgh July 29.

CHARLES F. STERNS, 59, vice-president and treasurer of the Sterns Electrical Equipment Co., Buffalo, N. Y., died July 23, in a Buffalo hospital. He had been associated with the family business for more than 30 years.

MEETINGS

THE INDUSTRIAL INSTITUTE
Round table conferences, Silver Bay on Lake George, N. Y., Aug. 10-25. Charles R. Towson, secretary, 347 Madison Ave., New York, N. Y.

INTERNATIONAL INDUSTRIAL RELATIONS CONGRESS
Amsterdam, Holland, Aug. 23-29. Information from Mary van Kleeck, Russell Sage Foundation Bldg., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
National aeronautic meeting, Sept. 1-3, Hotel Statler, Cleveland. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

INTERNATIONAL ASSOCIATION FOR THE TESTING OF MATERIALS
First Congress, Sept. 6-12, Buildings of the Swiss Federal Polytechnicum, Zurich, Switzerland. C. L. Warwick, secretary-treasurer, A.S.T.M., 1315 Spruce St., Philadelphia, Pa., or W. H. Fulweiler, A.S.T.M. representative on the Permanent Committee, Chemical Engineer of the United Gas Improvement Co., Philadelphia.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
First fall meeting, Chicago, Sept. 17. Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

NATIONAL METAL CONGRESS AND EXPOSITION
Exposition on Commonwealth Pier and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Meetings of American Welding Society and American Society for Steel Treating in connection. Information from W. H. Eisenmann, secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS
National production meeting, Detroit, Mich., Oct. 7-8. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

SOCIETY OF INDUSTRIAL ENGINEERS
Annual meeting, Pittsburgh, Pa., Oct. 14-16. George C. Dent, secretary, 205 W. Wacker Drive, Chicago, Ill.

NATIONAL SAFETY COUNCIL
Twentieth Annual Safety Congress, Chicago, Ill., Oct. 12-16. W. H. Cameron, secretary, 20 North Wacker Drive, Chicago.

GRAY IRON INSTITUTE
Fourth annual convention, West Baden Springs Hotel, West Baden Springs, Ind., Oct. 15-16. J. Arthur Tuscany, secretary, Terminal Tower Bldg., Cleveland.

AMERICAN MANAGEMENT ASSOCIATION
Industrial marketing conference, Hotel Statler, Cleveland, Ohio, Oct. 21-23. Headquarters, 20 Vesey St., New York, N. Y.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
New York meeting, Oct. 22. Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
National transportation meeting, Washington, D. C., Oct. 27-29. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION
Annual convention, New York, N. Y., Nov. 17-19, devoted to the general theme of Coordinated Industrial Planning. Headquarters, 20 Vesey St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Calif., Long Beach—Fields Chemical Corp., 1202 Financial Center Bldg., Los Angeles, plans the construction of a metallurgical coke plant, here, initial capacity 20 tons per day.

Calif., Los Angeles—Austin Securities Co., 727 West 7th St., awarded contract for a 60 x 176 ft. factory and warehouse on East 12th St. **Maturity in September.**

Calif., Los Angeles—Curtis Mfg. Co., Inc., 405 Lane Mortgage Co. Bldg., awarded contract for a 1 and 2 story, 200 x 575 and 100 x 100 ft; factory and office at San Fernando Rd. and Brazil St. Estimated cost $200,000. V. W. Houghton, 617 North New Hampshire St., Archt. C. A. Sanborn & Co., Ltd., 910 Black Bldg., Consulting Mechanical and Electrical Engrs. E. J. Walsh, 515 Orange Grove Ave., Alhambra, Structural Engr.

Calif., West Los Angeles — Albatross Steel Furniture Co., had plans made for a 1 story addition to factory. Estimated cost $70,000, including equipment. F. D. Rutherford, Mills-Fraser Bldg., Santa Monica, Calif., Archt.

Conn., Ansonia—American Brass Co., Grand and Meadow Sts., Waterbury, will build addition to plant on Canal St. here. Work will be done by day labor. Noted April 30.

Ill., Chicago—Clearing Industrial District, 38 South Dearborn St., Owners and Contractors, will build a 2 story factory at 6901-23 West 65th St. Estimated cost $500,000. Pepsodent Co., 619 North Michigan Ave., tooth paste and antiseptic manufacturers, lessee.

Ind., Evansville — Sunbeam Electric Co., awarded contract for a factory on West Morgan St. Estimated cost $40,000. Noted June 25.

Mass., Brighton (sta. Boston)—Dept. of Public Buildings, will soon receive bids for a 1 story garage for Police Station 14 here. Estimated cost $40,000. J. M. Gray, 175 High St., Boston, Archt.

Mass., Brockton—Taunton Lumber Co., 243 North Montello St., awarded contract alterations and additions to plant on North Montello St. Estimated cost $50,000.

Mass., Canton—Plymouth Rubber Co., Inc., Revere St., is receiving bids for a 2 story factory unit. Estimated cost $40,000. J. R. Worcester Co., 79 Milk St., Boston, Engr.

Mass., Willimansett—Palmer Steel Co., 1694 Main St., Springfield, awarded contract for 1 story, 80 x 180 and 60 x 360 ft. additions to factory at East Meadow St., here. Estimated cost to exceed $40,000.

Mich., Flint — Bd. of Trustees, Michigan School for the Deaf, is receiving bids for a 2 and 3 story training school, including mechanical and industrial shop. Estimated cost $150,000. Mackenzie & Pratt, Flint, Archts. Noted April 23.

Minn., St. Paul—Capitol Iron & Metal Co., 1428 Second St., plans to rebuild part of plant recently destroyed by fire. Loss $40,000.

Miss., Jackson—Dixie Glass Bottle Mfg. Co., W. M. Snyder, Pres., awarded contract for the construction of a factory. Estimated cost $150,000.

Mo., Springfield—Missouri State Highway Dept., Jefferson City, awarded tentative contract for a division garage here. $33,000. Noted July 23.

N. J., Newark—H. Rotman & Co., 35 Prince St., acquired 2 story building at 185-87 Camden St. and plans to remodel for the manufacture of refrigerators, show cases, butchers fixtures, etc.

N. J., Newark—Unique Arts Mfg. Co., 196 Waverly Ave., is having revised preliminary plans prepared for the construction of a 1 story factory. Estimated cost $50,000. S. Shaw & Co., 24 Commerce St., Archt. and Engr. Noted May 21.

N. J., Paterson — Owner, c/o J. C. Van Vlandren, 140 Market St., Archt., postponed construction of a 1 and 2 story industrial plant, $40,000. Maturity about October. Noted July 23.

N. J., Trenton—C. V. Hill & Co., Pennington Ave., plans the construction of a porcelain plant. Estimated cost $50,000. Private plans.

N. J., Trenton—New Jersey Porcelain Co., Pennsylvania Ave., awarded contract for a tunnel kiln. Estimated cost $35,000.

N. J., Union City—Owner, c/o J. G. Helmers, 147 Summit Ave., Archt., is having plans prepared for a 2 story garage on 14th St. Estimated cost $150,000.

N. Y., Mamaroneck—Chatsworth Furniture & Decorating Co., 72 Chatsworth Ave., Larchmont, plans the construction of a service building, workroom and store here. Estimated cost to exceed $40,000 including equipment.

N. Y., New York—A. Alberti c/o Frank Angelilli, 30 Main St., Yonkers, Contr., plans the construction of a service garage at 214 West Houston St. Estimated cost $40,000.

N. Y., New York—Owner, c/o H. S. Ely Co., 76 William St., plans the construction of a 3 story service garage at 537 West 20th St.

N. Y., St. George (sta. Staten Island)—W. C. Martin, Supt. of School Bldgs., Bd. of Education, Flatbush Ave. Ext. and Concord St., Brooklyn, will soon award contract for the construction of a vocational and continuation school at Wall St. from St. Marks Pl. to Belmont Pl. here.

N. C., Asheboro—Cranford Furniture Co., awarded contract for a 2 story addition to plant.

N. C., Goldsboro—Wayne Agricultural Works, manufacturers of plows and other agricultural implements, plans to rebuild plant destroyed by fire. Loss $75,000.

O., East Liverpool—Patterson Foundry & Machine Co., plans the construction of a factory unit to house new power plant, including three generating units to be used by three factories on St. George St. Estimated cost $75,000. Private plans. Maturity late October.

Okla., Tulsa—City Commissioners, E. Logan, Auditor, will receive bids until Aug. 14 for a 1 story, 60 x 72 ft. fire alarm building and 38 x 65 ft. garage at Central Park. Estimated cost $275,000. Smith & Senter, 306 Philtower Bldg., Archts.

Pa., Ambridge—Spang Chalfant & Co., Inc., Clark Bldg., Pittsburgh, plans an electric welding pipe mill here. Private plans.

Pa., Aspinwall—National Torch Tip Machine Co., 125 Washington Blvd., Pittsburgh, awarded contract for a 1 story, 50 x 75 and 12 x 17 ft. factory and office on Freeport Rd. Estimated cost $40,000.

Pa., Philadelphia — Wilkening Mfg. Co., Seventy First St. and Kingsessing Ave., awarded contract for addition and alterations to factory for the manufacture of piston rings, etc.

R. I., Providence—State Board of Public Roads, State House, Providence, received lowest bid for the construction of a maintenance and service building at Arline and Okie Sts., from Merritt Chapman & Scott, 292 Pequot Ave., New London, Conn. $52,826.

Tex., Fort Sam Houston (sta. San Antonio)—Constructing Quartermaster, will receive bids until Aug. 24 for the construction of a 3 story, 458 x 572 ft. engineering shop, etc., at Duncan Field. Estimated cost $440,000.

Utah, Ogden—State Building Commission, Capitol Bldg., Salt Lake City, will soon receive bids for remodeling main building of State Industrial school here. Estimated cost $40,000. H. Pierce, Ogden, Archt. R. K. Brown, State Building Commission, Salt Lake City, Engr.

Ont., Spragge—J. J. McFadden Lumber Co., plans to rebuild sawmill recently destroyed by fire $200,000. Work will be done by day labor.

Ont., Toronto—City plans the construction of a civic airport including buildings, etc., in Northwestern District. Estimated cost $250,000. R. C. Harris, City Hall, Engr.

Que., Montreal—American Manganese Steel Co., 230 Park Ave., New York, N. Y., plans the construction of a foundry and steel plant on St. Lawrence River here. Estimated cost $2,000,000. **Maturity indefinite.**

Que., Montreal—Canadian General Electric Co. Ltd., 941 Inspector St., awarded contract for the construction of a 69 x 154 ft. warehouse at Beaver Hall Hill. Estimated cost $425,000.

Que., Montreal—McKesson & Robbins Inc., W. N. Van Fant, Pres., Grassmere Ave., Fairfield, Bridgeport, Conn., plans the construction of a plant here. Initial cost $1,000,000.

Que., Montreal—Rootes Ltd., London, England, manufacturers of Hillman and Humber cars and Conaner trucks, plans the construction of a plant here. Initial cost $250,000.

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until Aug. 14 for woodworking machinery, lathe chuck, etc.

N. Y., Brooklyn — W. C. Martin, Supt. of School Buildings, Bd. of Education, Flatbush Ave. Ext. and Concord St.—will receive bids until Aug. 10 for printing shop equipment, shop equipment and small tools, equipment and supplies in additions to P. S. 228 (David A. Boody Junior High School), Ave. S. and West 4th to West 5th Sts.

Tex., Sugarland—State Bd. of Control, Austin—will receive bids until Aug. 12 for equipment including mill work, builders hardware, laundry machinery, etc., for proposed Institution improvements here.

Que., Montreal—P. Bachand, 1389 Park Lafontaine—complete equipment for automobile repair shop and service station.

Que., Montreal—Institution Sante Naturelle, 1410 Plessie St.—complete equipment for aluminum foundry.